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REPLACING A PSEUDO-PILOT BY SPEECH GENERATION AND RECOGNITION TECHNOLOGY

VOLUME II

Prepared for
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Replacing a pseudo-pilot by speech generation and recognition technology

Volume II

by

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Research Centre

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NOTE: The opinions and views expressed in this report are those of the author, and do not necessarily reflect those of the Transportation Development Centre of Transport Canada.

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16. Abstract

Objective : The objective of this report is to determine how to replace a human pseudo-pilot with a device using speech recognition and generation technology.

Method : First, the state of the applied research in North America and Europe is surveyed. Then, a custom language model for air traffic control is developed. Finally, the use of speech recognition and generation technology for this application is reviewed.

Results : Although several systems are in the development stage, none is in current use. The use of a frame-based language model is recommended in this application. Recommendations are made regarding the use of speech recognition and generation technology.

Conclusion : The development of a voice driven pseudo-pilot seems technically feasible. However, a choice must be made between a passive system (e.g. voice-driven simulator) and an active system (e.g. one that will coach the trainee). A choice must also be made between an entirely Canadian system and a system developed in cooperation with a partner already active in this field.

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16. Résumé

But : ce rapport vise à déterminer comment on peut remplacer un pseudo-pilote humain par un dispositif utilisant des techniques de reconnaissance et de génération de la parole.

Méthode : on examine d'abord l'état actuel de la recherche appliquée en Amérique du Nord et en Europe. On élabore ensuite un modèle sur mesure du langage des élèves contrôleurs. On examine alors l'utilisation des technologies de reconnaissance et de génération de la parole.

Résultats : on constate qu'il y a un certain nombre de systèmes en cours de développement, même si aucun n'est encore en exploitation. On propose la représentation par schémas comme modèle de langage pour un pseudo-pilote automatisé. On formule des recommandations sur l'exploitation des technologies de reconnaissance et de génération de la parole.

Conclusion : il semble techniquement faisable de réaliser un pseudo-pilote automatisé. On doit cependant choisir si on veut un système passif (i.e. un simulateur commandé par la voix) ou un système actif (i.e. qui conseillera l'élève-contrôleur). On doit aussi choisir si on veut un système réalisé entièrement au Canada ou si on désire établir une coopération avec un organisme qui développe actuellement des pseudo-pilotes automatisés.

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APPENDICES

Appendix A: Excerpt from the course plan used at the Transport Canada Training Institute, Cornwall, Ontario

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Appendix I: Vocabulary used by trainee controllers in complex exercises

Appendix J: Draft of additional frames for complex exercises

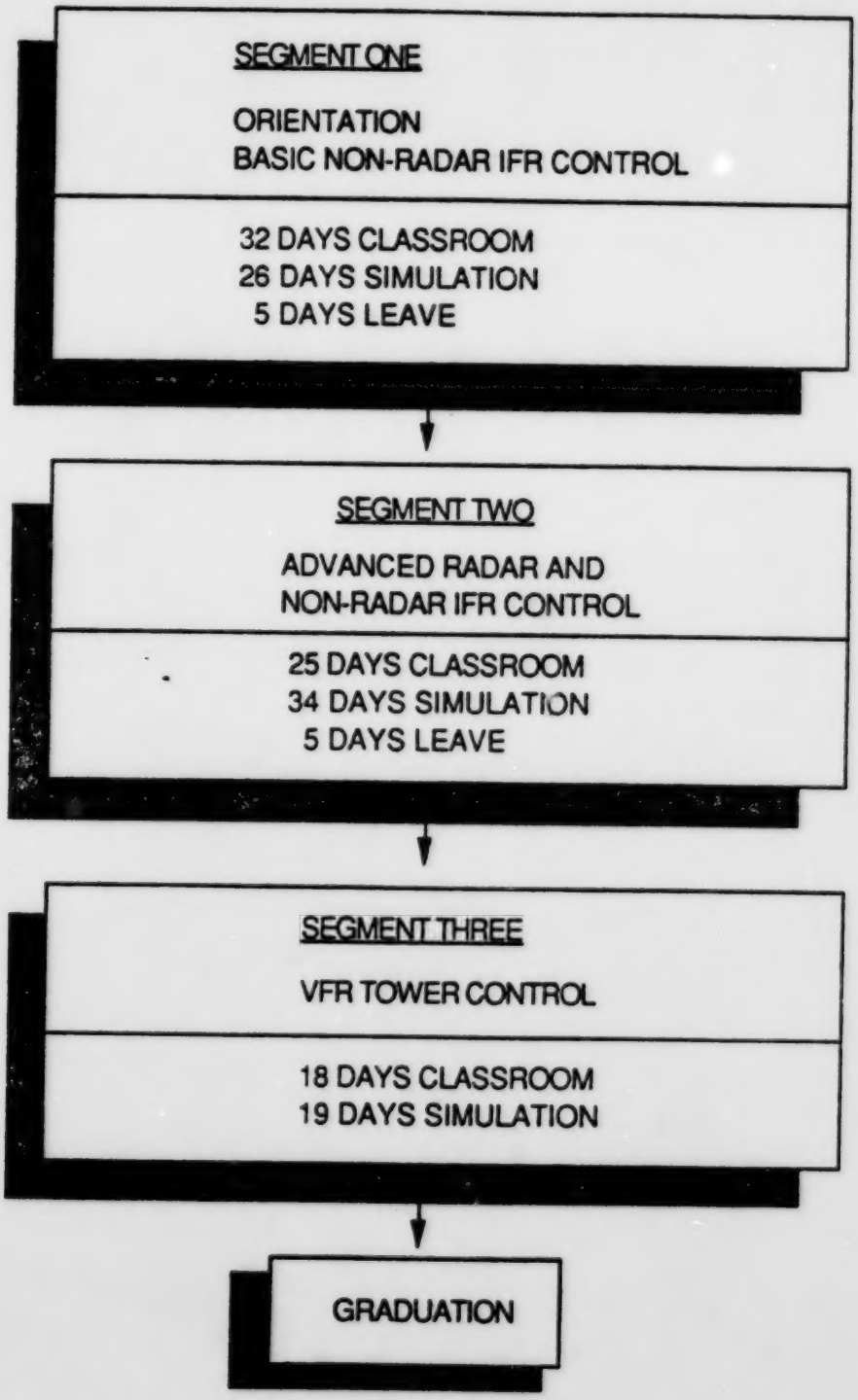
Appendix K: Analysis of concatenated transmissions

Appendix L: Vocabulary used by pseudo-pilots

APPENDIX A : **Excerpt from the course plan used at the Transport Canada Training Institute, Cornwall, Ontario**

STUDY NOTE ORIENTATION

BASIC ATC MAINSTREAM COURSE



STUDY NOTE ORIENTATION

SEGMENT TWO - ADVANCED RADAR AND NON-RADAR IFR CONTROL OVERVIEW

TO6 NON-RADAR IFR CONTROL

ASSESSMENT TEST #1

TO1 RADAR CONTROL - VECTORING
SIMULATION EXERCISES

TO7 METEOROLOGY
PRACTICE WEATHER OBSERVATIONS

MET ASSESSMENT TEST 1

ASSESSMENT TEST #2

TO2 RADAR CONTROL - HIGH LEVEL
SIMULATION EXERCISES

TO3 RADAR CONTROL - LOW LEVEL
SIMULATION EXERCISES

TO4 RADAR CONTROL - TERMINAL
SIMULATION EXERCISES

MET ASSESSMENT TEST 2

TO5 RADAR CONTROL - COMBINED OPERATION
SIMULATION EXERCISES

ASSESSMENT TEST #3

MET ASSESSMENT TEST 3

SKILL TEST - COMBINED OPERATION

APPENDIX B : Transcripts of simple exercises

Transcript : IFR novice, ID= 1A

Notes:
A message issued by a trainee controller is preceded by C=.
A message issued by the pseudo-pilot is preceded by P=.
A message issued by another control center is preceded by Other-center or the other center name.
A *** signals a phrase fragment that has not been identified.**
A iiiii signals a word that has been incompletly pronounced.

C= November nine hundred Papa Bravo say your heading

P= November nine zero zero Papa Bravo steady three five five

C= November nine nine zero zero Papa Bravo vectors for spacing turn right heading zero three five

P= confirm right zero three five for November zero zero Papa Bravo

C= confirm zero three five

P= roger

C= November nine zero zero Papa Bravo maintain one two thousand Stilpond altimeter two niner niner two report leaving flight level two four zero

P= November nine zero zero Papa Bravo leaving flight level two five zero now for one two thousand call you at a flight level two four zero roger

P= Midtown November nine zero zero Papa Bravo at a flight level two four zero

C= November nine hundred Papa Bravo center roger break Air Canada nine five one maintain one two thousand Stilpond altimeter two niner niner two

P= Canada nine five one leaving flight level two four zero now for flight iiiii leaving two four zero for one two thousand roger check altimeter two niner niner two

C= November nine hundred Papa Bravo fifteen miles east of Juliet five six five vectors to re-intercept turn left heading three one five

P= left three one five to intercept the Stilpond one seven six November nine zero zero Papa Bravo roger

C= November nine zero zero Papa Bravo maintain normal navigation

P= November nine zero zero Papa Bravo roger

Other-center= Avalanche Eastview hand-off *****

C= say again

Other-center= Avalanche Eastview hand-off *****

C= go ahead

Other-center= one five miles south of ***** on Juliet five six seven Lufthansa four seven one flight level two eight zero colocated with Air France zero three one flight level two six oh

C= ***** four seven one radar identified Air France zero three one radar identified ***** Foxtrot

P= Town center Lufthansa four seven one your frequency flight level two eight zero

C= ***** four seventy-one center roger

P= Town center Air France zero three one with you flight level two six zero

C= Air France zero three one center roger

C= Eastview Mooselake *****

Eastview= go ahead

C= I-11 be vectoring Lufthansa four seventy-one ten miles *instructor-intervention:within-ten-miles* within ten miles of the boundary east of Avalanche descending to one two thousand

Eastview= **********

C= ***** Foxtrot

C= Lufthansa four seven one say your heading

C= Lufthansa four seven one say your heading

**********communication-problem**********

C= iiiii Lufthansa four seventy-one say your heading

P= Lufthansa four seven one steady three five five

C= iiiii Lufthansa four seven one vectors for spacing turn right heading zero three five report

P= confirm right to zero three five for Lufthansa four seven one

C= terminal Mooselake handoff south

other center= go ahead

other center= terminal go ahead

C= on the boundary instructor-intervention:on-the-one-seven-six-radial* on the one seven six radial Air Canada nine five one *instructor-intervention:thats-it* ten miles from boundary *instructor-intervention:ten miles in trail* ten miles in trail November nine hundred Papa Bravo

other center= Air Canada nine five one identifed November nine zero zero Papa Bravo identified *****

C= ***** foxtrot

C= Air Canada nine five one contact Stilpond terminal one twenty five fifteen

P= two five one five Air Canada nine five one roger

C= November nine zero zero Papa Bravo contact Stilpond terminal on one two five decimal one five

P= two five one five November nine zero zero Papa Bravo good day

C= ***** Lufthansa ***** turn *****

P= I asked ***** to confirm the turn *****

C= zero three five

P= roger

P= end of turn

C= Lufthansa four seven one maintain one two thousand Stilpond altimeter two niner niner two report leaving flight level two six zero

P= Lufthansa four seven one leaving flight level two eight zero for one two thousand will call you at a flight level two six zero roger

P= Midtown Lufthansa four seven one passing through flight level two six zero

C= Lufthansa four seventy one center roger break Air France zero three one maintain one two thousand Stilpond altimeter two niner niner two

P= France zero three one leaving flight level two six zero for one two thousand altimeter two niner niner two roger

C= Duluth four iiiii Lufthansa four seven one fifteen miles east of Juliet five six seven to reintercept on course turn left heading three one five resume normal navigation

P= left turn three one five to intercept Stilpond one seven six radial Lufthansa four seven one roger

other-center= Avalanche Eastview handoff ***

C= maintain go ahead

other-center= at ***** i-ve got three for you first Canadian six three flight level two six zero colocated with Air Canada eight five seven flight level two eight zero and Alitalia six six five flight level three one zero

C= Canadian sixty three Air Canada eight five seven Alitalia six sixty five identified and requesting control for vectors east

other-center= all three your control vectors approved

C= that east and *****

other-center= that-s *****

C= ***** Foxtrot

C= Alitalia six sixty five say your heading

P= iiiii Alitalia six six five steady three five five

C= Alitalia six sixty five vectors for spacing turn right heading zero five five

P= right zero five five Alitalia six five five

P= Midtown Air Canada eight five seven your frequency flight level two eight zero

C= Air Canada eight fifty seven Mooselake iiiii Air euh midtown center roger

P= Town Canadian six three with you flight level two six zero

C= Canadian sixty three midtown center roger

P= Midtown Air France zero three one level one two thousand

C= Air France zero iiiii thirty one check your level one two thousand
P= Town Lufthansa four seven one level one two thousand

C= ***** can you say again

P= town Lufthansa four seven one level one two thousand

C= Lufthansa four seven one center roger

C= Canadian six three vectors for spacing turn right heading three five

P= Canadian six three in the right turn zero three five roger

C= Canadian six three disregard euh maintain heading three five five Air Canada eight five seven vectors for spacing turn right heading zero three five

P= right zero three five Air Canada eight five seven roger

C= terminal Mooselake handoff south

other-center= terminal go ahead

C= on the iiiii on the boundary euh iiiii one seven six radial Air France zero three one in trail Duluth four seventy one

other-center= Air France zero three one identified confirm the name second one

C= *instructor-intervention:Duluth*

other-center= Lufthansa four seven one identified *****

C= ***** Foxtrot

C= Air iiiii Air France zero three one contact Stilpond terminal one two five decimal one five

P= two five one five Air France zero three one roger

C= Duluth four seventy-one contact Stilpond terminal Lufthansa four seventy-one contact Stilpond terminal one two five decimal one five

P= Lufthansa four seven one one two five one five

C= Alitalia six sixty five turn left heading zero three five

C= and Alitalia six six six five maintain one two thousand report leaving report leaving flight level two eight zero

P= Alitalia six six five left turn zero three five and descent to euh leaving flight level two eight zero now for one two thousand call you at a flight level euh two eight zero

C= euh Stilpond altimeter two niner niner two

P= and check we-re at a flight level three one zero for one two thousand call you through two eight zero

P= check altimeter two niner niner two

P= Town Alitalia six six five at a flight level two eight zero

C= Alitalia six six five center roger break Air Canada eight five seven maintain one two thousand Stilpond altimeter two niner niner two report leaving flight level two six zero

P= Air Canada eight five seven leaving flight level two eight zero now for one two thousand altimeter two niner niner two call you at a flight level two six zero roger

C= Air Canada eight five seven fifteen miles east of Juliet five six seven vectors to iiiii re-intercept airway turn left heading three one five

P= Air Canada eight five seven in left turn to intercept Juliet five six seven roger

C= Air Canada eight five seven resume normal navigation

P= Canada eight five seven roger

C= Alitalia six sixty five twenty five miles east of Juliet five six seven vectors to re-intercept airway turn left heading three one five resume normal navigation

P= Alitalia six six five left three one five turn to intercept Juliet five six seven roger

P= Town Air Canada five six seven passing through flight level two six zero

C= Air Canada eight fifty seven center roger break Canadian sixty three maintain one two thousand Stilpond altimeter two niner niner two

P= Canadian six three leaving flight level two six zero for one two thousand altimeter two niner niner two roger

C= Terminal Mooselake handoff south

other-center= terminal go ahead

C= ten miles from the boundary on one seven six radial Canadian six three ten miles in trail Air Canada eight five seven and ten miles in trail behind Air Canada eight five seven Alitalia six sixty five

Transcript : IFR novice, ID=2A

Notes:
A message issued by a trainee controller is preceded by C=.
A message issued by the pseudo-pilot is preceded by P=.
A message issued by another control center is preceded by Other-center or the other center name.
A *** signals a phrase fragment that has not been identified.**
A iiiii signals a word that has been incompletly pronounced.

C= November Papa Bravo maintain one two thousand Stilpond altimeter two niner niner two report leaving flight level two four zero

P= November nine zero zero Papa Bravo leaving flight level two five zero for one two thousand call you at flight level two four zero

P= Midtown November nine zero zero Papa Bravo through flight level two four zero

C= November nine zero zero Papa Bravo Roger break Air Canada nine five one maintain one two thousand Stilpond altimeter two niner niner two

P= Air Canada nine five one leaving flight level two four zero for one two thousand altimeter two niner niner two roger

C= Air Canada nine five one center roger

C= November Papa Bravo euh vectors to reintercept Juliet five six seven turn left heading three three one five to reintercept the airway resume normal navigation

P= left turn heading three one five to intercept the euh the airway on course November nine zero zero Papa Bravo roger

C= Eastview Mooselake i have a target at *****

Eastview= roger three miles north of ***** Juliet five six seven I-ve got Air France zero three one flight level two six zero Lufthansa four seven one flight level two eight zero

C= target identified Air France zero three one Lufthansia four seven one *****

C= euh Stilpond Mooselake handoff south

Stilpond= Stilpond go ahead

C= euh five miles from the boundary euh Juliet and euh one seven six radial Air Canada nine five one euh descending *instructor-intervention:that-s-enough* euh ten miles in trail November nine zero zero Papa Bravo

Stilpond= Air Canada nine five one identifying negative target *****

P= town Center Lufthansa four seven one your frequency flight level two eight zero

C= Air Canada nine five one iiiii contact Stilpond terminal at one two five decimal one five now

P= two five one five Air Canada nine five one roger

C= Lufthansa midtown center Lufthansia four seven one midtown center roger

P= midtown Air France zero three one your frequency flight level two six zero

C= Air France zero three one center roger

C= ***** Eastview midtown *****

Eastview = go ahead

C= I'll be vectoring Lufthansia four seven one within ten miles from the boundary to descending to one two thousand

Unidentified= that-s ***** watch

C= Lufthansa four seven one say your heading

P= Lufthansa four seven one steady three five five

C= Lufthansia four seven one turn right heading zero three five

P= right turn zero three five Lufthansa for seven one

C= Stilpond Mooselake handoff five miles south of the border

Stilpond= Stilpond go ahead

C= euh November nine zero zero Papa Bravo five miles from Stilpond eeeh one seven six radial Papa Alpha

Stilpond= november nine zero zero Papa Bravo identified *****

C= November Papa Bravo contact euh Stilpond terminal one two five decimal one five now

P= one two five one five November nine zero zero Papa Bravo

C= Lufthansia four seven one euh descend to one two thousand maintain one two thousand euh Stilpond altimeter two niner niner two report iiiii leaving flight level two six zero

P= Lufthansa four seven one leaving flight level two eight zero for one two thousand will call you at a flight level two six zero check altimeter two niner niner two

C= Lufthansia four seven one fifteen miles east of Juliet five six seven vectors to reintercept the airway turn left heading three five five three one five euh resume normal navigation

P= Lufthansa four seven one left three one five to intercept Juliet five six seven and check we are just passing through flight level two six oh now

C= Lufthansia four seven one center roger break Air France zero three one maintain one two thousand Stilpond altimeter two niner niner two

P= France zero three one leaving flight level two six zero now for one two thousand altimeter two niner niner two roger

C= Air France zero three one center roger

C= iiiii Eastview Mooselake target at ***** Eastview I have target at *****

Other center= roger at ***** I've got three for you first on the Air Canada eight five seven flight level two eight zero colocated with Alitalia six six five flight level three one zero and Canadian six three flight level two six oh

C= Eastview target identified

C= Canadian six three Air Canada eight five seven iiiii Alitalia six six five all identified

Eastview= roger

P= Midtown center Canadian six three your frequency flight level two six zero

C= Canadian six three center standby

C= Eastview midtown *****
Other center= Eastview go ahead

C= ***** handed off ***** flight control for vectors to descend

Other center= had a squelch problem

C= Canadian six three midtown center say your altitude

P= Midtown Canadian six three level flight level two six zero your frequency

C= Canadian six three center roger

P= Town center Canada eight five seven flight level two eight zero your frequency

C= Air Canada eight five iiiii seven center roger

P= Midtown Alitalia six six five with you flight level three one zero

C= Alitalia six six five midtown center roger

C= Alitalia six six five say your heading

P= Alitalia six six five we-re steady heading three five five

C= Alitalia vectors for spacing turn right on a heading of zero five five

P= right turn zero five five Alitalia six six five roger

C= Stilpond Mooselake handoff south

Stilpond center= go ahead

C= euhh five miles *instructor-intervention:inside* inside the boundary south bound *instructor-intervention:on-the-one-seven-six-radial* on the one seven six radial euh Air France zero three one ten miles in trail Lufthansa four seven one

Stilpond center= Air France zero three one identified Lufthansa four seven one identified

C= Air Canada eight five seven center

P= Town center Air Canada eight five seven go ahead

C= Air Canada eight five seven vectors for spacing turn right on a heading of three three five correction heading zero three five

P= Right zero three five Air Canada eight five seven roger

C= Air France zero three one contact Stilpond terminal one two five decimal one five

P= two five one five Air France zero three one good day

C= Lufthansia four seven one contact Stilpond terminal one two five decimal one five now

P= two five one five Lufthansa four seven one

C= Alitalia six six five euh turn left heading zero three five

P= left zero three five Alitalia six six five

C= Alitalia six six five maintain one two thousand report leaving flight level two eight zero euh Stilpond altimeter two niner niner two

P= Alitalia six six five leaving flight level three one zero now for flight euh for one two thousand call you through flight level two eight zero

C= Alitalia six six five roger

C= Air Canada eight five seven vectors to reintercept the airway euh fifteen miles east of Juliet five six seven turn left heading three five five to reintercept the airway resume normal navigation

P= Canada eight five seven left three five five i don-t think we'll intercept on that heading

C= Air Canada eight five seven correction turn left heading three one five

P= Canada eight five seven left on three one five to intercept roger

P= Midtown Alitalia six six five at the flight level two eight zero

C= Alitalia six six five roger break Air Canada eight five seven maintain one two thousand Stilpond altimeter two niner niner two report leaving flight level two six zero

P= Canada eight five seven leaving flight level two eight zero for for one two thousand altimeter two niner niner two will call you through flight level two six zero

C= midtown to ***** eight five seven roger

C= Alitalia six six five center twenty five miles east of Juliet five six seven turn left heading three one five to reintercept the airway resume normal navigation

P= left three one five to intercept Alitalia six six five

C= Canadian six three maintain one two thousand Stilpond altimeter two niner niner two

P= Canadian six three leaving flight level two six zero for one two thousand altimeter two niner niner two

P= Air Canada eight five seven sorry I missed the call I-m at flight level two six oh

C= Air Canada eight five seven center roger

C= Stilpond Mocselake handoff south

Stilpond= go ahead

C= five miles south of boundary euh euh one seven six radial Canadian six three Papa Alpha

Stilpond= Canadian six three identified *****

C= Canadian six three contact Stilpond terminal one two five decimal one five now

P= two five one five Canadian six three

APPENDIX C : **Vocabulary used by trainee controllers in simple exercises**

COMBINED VOCABULARIES :
(Transcr. 1a and 2a)

A
AGAIN
AIRWAY
ALTIMETER
ALTITUDE
AND
AT
BREAK
CAN
CHECK
CONFIRM
CONTACT
CORRECTION
COURSE
DECIMAL
DESCEND
DISREGARD
EUH
FLIGHT
FOR
HEADING
IIIII
LEAVING
LEFT
LEVEL
MAINTAIN
MILES
NAVIGATION
NORMAL
NOW
OF
ON
REINTERCEPT
REPORT
RESUME
RIGHT
ROGER
SAY
SPACING
STANDBY
THE
TO
TURN
VECTORS
YOU
YOUR
*****
==========

Total (without iiiii and *****) = 45

APPENDIX D : Preparation of individual frames for simple exercises

FRAME : HDR
Messages issued by : trainee controller

Trscr. msg no.	Content of message								
1a	1 november	nine	hundred	papa	bravo	say	your	heading	
	31 lufthansa	four	seven	one		say	your	heading	
	32 lufthansa	four	seven	one		say	your	heading	
	33 lufthansa	four	seventy-one			say	your	heading	
	67 alitalia	six	sixty	five		say	your	heading	
2a	26 lufthansa	four	seven	one		say	your	heading	
	61 alitalia	six	six	five		say	your	heading	
	*******	*******	*******	*******	*******	*******	*******	*******	
		callsign				"say"	"your"	"heading"	

FRAME : HDA
Messages issued by : pseudo-pilot.

Trscr. msg no.	Content of message									
1a	2 november	nine	zero	zero	papa	bravo	steady	three	five	five
	34 lufthansa	four	seven	one			steady	three	five	five
	68 iiiii	alitalia	six	six	five		steady	three	five	five
2a	27 lufthansa	four	seven	one			steady	three	five	five
	62 alitalia	six	six	five			we-re	steady	heading	three
									five	five
	*******	*****	*******	*******	*******	*******	*******	*******	*******	***
		callsign					"we-re"	"steady"	"heading"	cap

FRAME : HDD
Messages issued by : trainee controller

Trscr. msg no.	Content of message									
1a	96 alitalia	six	sixty-five		turn	left	heading	zero	three	five
2a	28 lufthansa	four	seven	one	turn	left	heading	zero	three	five
	77 alitalia	six	six	five	euh	turn	left	heading	zero	three
										five
	(84) air	canada	eight	five	seven	correctieturn		left	heading	three
									one	five
	*******	*******	****	*******	*******	*******	*******	**	******	****
		callsign				"turn" side		"heading"	heading	

FRAME : HDE
Messages issued by : pseudo-pilot.

Trscr. msg no.	Content of message								
1a	98 alitalia	six	six	five	left	turn	zero	three	five
2a	29 right	turn	zero	three	five	lufthansa	four	seven	one
	78 left	zero	three	five	alitalia	six	six	five	
	(85) canada	eight	five	seven	left	on	three	one	five
							to	intercept	roger
	*******	*******	*******	*******	*******	*******	*******	*******	*****
	callsign			side	"on"	heading	"to"	"intercept"	

FRAME : VRD
Messages issued by : trainee controller

Trscr.	msg no.	Content of message								
1a	12	november	nine	hundred	papa	bravo	fifteen	miles	east	of
		juliet	five	six	five	vectors	to	re-interoturn		left
		heading	three	one	five					
	14	november	nine	zero	zero	maintain	normal	navigation		
	57	duluth	four	iiiii	lufthansafour		seven	one	fifteen	miles
		east	of	juliet	five	six	seven	to	reinterce on	
		course	turn	left	heading	three	one	five	resume	normal
		navigation								
	105	air	canada	eight	five	seven	fifteen	miles	east	of
		juliet	five	six	seven	vectors	to	iiiii	re-intercairway	
		turn	left	heading	three	one	five			
	107	air	canada	eight	five	seven	resume	normal	navigation	
	109	alitalia	six	sixty-fivtwenty		miles	east	of	juliet	five
		six	seven	vectors	to	re-intercturn		left	heading	three
		one	five	resume	normal	navigation				
2a	7	november	papa	bravo	euh	vectors	to	re-interojuliet		five
		six	seven	turn	left	heading	three	three	one	five
		to reintercept		the	airway	resume	normal	navigation		
	38	lufthansa	four	seven	one	fifteen	miles	east	of	juliet
		five	six	seven	vectors	to	re-intercept		the	airway
		turn	left	heading	three	five	five	three	one	five
		euh	resume	normal	navigation					
	82	air	canada	eight	five	seven	vectors	to	re-intercept	
		the	airway	fifteen	miles	east	of	juliet	five	six
		seven	turn	left	heading	three	five	five	to	
		re-intercept		the	airway	resume	normal	navigation		
	90	alitalia	six	six	five	twenty	five	miles	east	of
		juliet	five	six	seven	turn	left	heading	three	one
		five	to	reintercept	the	airway	resume	normal	navigation	
		*******	******	*******	*******	******	*******	*******	*******	*******
		callsign	position		"vectors""to"		"re-intercept"	"the"	"airway"	

FRAME : VRE
Messages issued by : pseudo-pilot.

Trscr.	msg no.	Content of message								
1a	13	left	three	one	five	to	interceptthe		stilpond one	
		seven	six	november	nine	zero	zero	papa	bravo	
	58	left	turn	three	one	five	to	interceptstilpond one		
		seven	six	radial	lufthansafour		seven	one	roger	
	104	air	canada	eight	five	seven	in	left	turn	to
		intercept	juliet	five	six	seven	roger			
	110	alitalia	six	six	five	left	three	one	five	turn
		to	intercept	juliet	five	six	seven	roger		
2a	8	left	turn	heading	three	one	five	to	interceptthe	
		euh	the	airway	on	course	november	nine	zero	zero
		papa	bravo	roger						
	39	Lufthansa	four	seven	one	left	three	one	five	to
		intercept	juliet	five	six	seven	...			
	(83)	...								
	91	left	three	one	five	to	interceptalitalia six			six
		five								
		*******	*******	*******	*******	*******	*******	*******	*******	*******
		side	heading	"to"	"intercept"		airway	callsign		

FRAME : VSD
Messages issued by : trainee controller.

Trscr. msg no.	Content of message								
1a 3	november	nine	nine	zero	zero	papa	bravo	vectors	for
	spacing	turn	right	heading	zero	three	five		
35	iiii	lufthansafour		seven	one			vectors	for
	spacing	turn	right	heading	zero	three	five	report	nnnnn
69	alitalia	six	sixty-five					vectors	for
	spacing	turn	right	heading	zero	five	five		
81	canadian	six	three					vectors	for
	spacing	turn	right	heading	three	five			
83	air	canada	eight	five	seven	vectors	for	spacing	turn
	right	heading	zero	three	five				
2a 63	alitalia							vectors	for
	spacing	turn	right	on	a	heading	of	zero	five
	five								
71	air	canada	eight	five	seven			vectors	for
	spacing	tur	right	on	a	heading	of	three	five
	five	correction		heading	zero	three	five		
	callsign	"vectors""for"	"spacing""turn"	side	"on"	"a"	"heading"	"of"	heading

FRAME : VSE
Messages issued by : pseudo-pilot.

Trscr. msg no.	Content of message								
1a 70	right	zero	five	five	alitalia six		five	five	
82	canadian	six	three	in	the	right	turn	zero	three
	five	roger							
84	right	zero	three	five	air	canada	eight	five	seven
	roger								
2a 64	right	turn	zero	five	five	alitalia six		six	five
	roger								
72	right	zero	three	five	air	canada	eight	five	seven
	roger								
	"in the"	side	"turn"	heading	callsign	"roger"			

FRAME : ALDF
Messages issued by : trainee controller.

Trscr.msg no.	Content of message								
1a 7	november	nine	zero	zero	papa	bravo	maintain one		two
	thousand	Stilpond	altimetertwo		niner	niner	two	report	leaving
	flight	level	two	four	zero				
52	lufthansa	four	seven	one			maintain one		two
	thousand	stilpond	altimetertwo		niner	niner	two	report	
	leaving	flight	level	two	six	zero			
(see 97	and	alitalia six	six	six	five	maintain one		two	
HDD)	thousand	report	leaving	report	leaving	flight	level	two	eight
	zero								
99	euh	stilpond	altimetertwo		niner	niner	two		
103	air	canada	eight	five	seven		maintain one		two
	thousand	stilpond	altimetertwo		niner	niner	two	report	leaving
	flight	level	two	six	zero				
2a 1	november	papa	bravo				maintain one		two
	thousand	stilpond	altimetertwo		niner	niner	two	report	leaving
	flight	level	two	four	zero				
36	lufthansa	four	seven	one	euh	descend	to	one	two
	thousand	maintain	one	two	thousand	euh	stilpond	altimetertwo	
	niner	niner	two	report	iiiii	leaving	flight	level	two
	six	zero							
79	alitalia	six	six	five			maintain one		two
	thousand	report		leaving	flight	level	two	eight	zero
	euh	stilpond		altimeter		two	niner	niner	two
87	air	canada	eight	five	seven		maintain one		two
	thousand	stilpond	altimetertwo		niner	niner	two	report	leaving
	flight	level	two	six	zero				
	callsign	"descend""to"		"maintain"	altitude	alt. ref."altimeter"			
				altimeter reading	"report"	"leaving"altitude			

FRAME : ALEF
Messages issued by : pseudo-pilot.

Trscr.	msg no.	Content of message								
1a	8	november	nine	zero	zero	papa	bravo	leaving	flight	level
		two	five	zero	now	for	one	two	thousand	call
		you	at	a	flight	level	two	four	zero	roger
	53	lufthansa	four	seven	one			leaving	flight	level
		two	eight	zero	for	one	two	thousand	will	call
		you	at	a	flight	level	two	six	zero	roger
(see HDR)	98	alitalia	six	six	five	left	turn	zero	three	five
		and	descent	to	euh	leaving	flight	level	two	eight
		zero	now	for	one	two	thousand	call	you	at
		a	flight	level	euh	two	eight	zero		
	100	and	check	we-re	at	a	flight	level	three	one
		zero	for	one	two	thousand	call	you	through	two
		eight	zero							
	101	check	altimeter	two	niner	niner	two			
	104	air	canada	eight	five	seven		leaving	flight	level
		two	eight	zero	now	for	one	two	thousand	
		altimeter	two	niner	niner	two	call	you	at	a flight
		level	two	six	zero	roger				
2a	2	november	nine	zero	papa	bravo		leaving	flight	level
		two	five	zero	for	one	two	thousand	call	you
		at	flight	level	two	four	zero			
	37	lufthansa	four	seven	one			leaving	flight	level
		two	eight	zero	for	one	two	thousand	will	call
		you	at	a	flight	level	one	two	thousand	check
		altimeter	two	niner	niner	two				
	80	alitalia	six	six	five			leaving	flight	level
		three	one	zero	now	for	flight	euh	for	one
		two	thousand	call	you	through	flight	level	two	eight
		zero								
	88	canada	eight	five	seven	leaving	flight	level	two	eight
		zero	for	one	two	thousand	stilpond	altimeter	two	niner
		niner	two	will	call	you	through	flight	level	two
		six	zero							

callsign	"leaving"	altitude	"now"	"for"	altitude	"altimeter"
altimeter	"will"	"call"	"you"	"through"	altitude	

FRAME : ALF
Messages issued by : trainee controller

Trscr.	msg no.	Content of message								
1a	9	midtown	november	nine	zero	zero	papa	bravo	at	a
		flight	level	two	four	zero				
	54	midtown	lufthansa	four	seven	one	passing	through	flight	level
		two	six	zero						
	102	town	alitalia	six	six	five	at	a	flight	level
		two	eight	zero						
	111	town	air	canada	five	six	seven	passing	through	flight
		level	two	six	zero					
2a	3	midtown	november	nine	zero	zero	papa	bravo	through	flight
		level	two	four	zero					
	39	...	and	check	we-re	just	passing	through	flight	level
		two	six	oh	now					
	86	midtown	alitalia	six	six	five	at	the	flight	level
		two								
	(94)	eight	zero							

center	callsign	"we-re"	"just"	"passing"	"through"	altitude		"now"

FRAME : ALR
Messages issued by : trainee controller

Trscr.	msg no.	Content of message							
2a	54	canadian	six	three	midtown	center	say	your	altitude
			callsign				"say"	"your"	"altitude"

FRAME : ALA
Messages issued by : pseudo-pilot.

Trscr.	msg no.	Content of message									
2a	55	midtown zero	canadian your	six frequency	three	level	flight	level	two	six	
		center	callsign			altitude		"your"	"frequency"		

FRAME : ALD
Messages issued by : trainee controller

Trscr.	msg no.	Content of message									
1a	10	air stilpond	canada	nine altimetertwo	five	one niner	maintain niner	one two	two	thousand	
	55	air stilpond	france	zero altimetertwo	three	one niner	maintain niner	one two	two	thousand	
	112	canadian stilpond	sixty-three	altimetertwo		niner	maintain niner	one two	two	thousand	
2a	4	air stilpond	canada	nine altimetertwo	five	one niner	maintain niner	one two	two	thousand	
	40	air stilpond	france	zero altimetertwo	three	one niner	maintain niner	one two	two	thousand	
	92	canadian stilpond	six	three altimetertwo		niner	maintain niner	one two	two	thousand	
		callsign	"maintain"	altitude		altimeter reference	"altimeter"		altimeter reading		

FRAME : ALE
Messages issued by : pseudo-pilot.

Trscr.	msg no.	Content of message									
1a	11	canada zero for niner	nine now one two	five for two	one flight thousand	leaving iiiii roger	flight leaving check	level two altimetertwo	two four	four zero niner	
	56	france zero two	zero for roger	three one	one two	leaving thousand	flight altimetertwo	level	two niner	six niner	
	113	canadian zero niner	six for two	three one roger	two	leaving thousand	flight stilpond	level altimetertwo	two	six niner	
2a	5	air four niner	canada zero two	nine for	five one	one two	leaving thousand	flight altimetertwo	level	two niner	
	41	france zero niner	zero now niner	three for two	one	leaving two	flight thousand	level stilpond	two altimetertwo	six	
	93	canadian zero niner	six for two	three one	two	leaving thousand	flight altimetertwo	level	two niner	six	
		callsign	"leaving"	altitude	"now"	"for"	altitude altimeter reference		"altimeter" reading		

FRAME : ALO
Messages issued by : pseudo-pilot.

Trscr.	msg no.	Content of message								
1a	75	midtown thousand	air	france	zero	three	one	level	one	two
	77	town	lufthansafour		seven	one	level	one	two	thousand
	79	town	lufthansafour		seven	one	level	one	two	thousand
		center		callsign			altitude			

FRAME : POD
Messages issued by : trainee controller

Trscr.	msg no.	Content of message								
1a	43	air terminal	canada one	nine twenty	five five	one fifteen			contact	stilpond
	45	november terminal	nine on	zero one	zero two	papa five	bravo decimal	one	contact five	stilpond
	92	air terminal	iiiii one	air two	france five	zero decimal	three one	one five	contact	stilpond
	94	duluth terminal two	four lufthansa five	seventy-one four decimal	seventy-one one	contact five	stilpond terminal one		contact	stilpond
2a	17	air terminal	canada at	nine one	five two	one five	iiii decimal	one	contact five	stilpond now
	34	november stilpond	papa terminal	bravo one	two	five	decimal	one	contact five	euh now
	73	air terminal	france one	zero two	three five	one decimal	one	five	contact	stilpond
	75	lufthansa terminal	four one	seven two	one five	decimal	one	five	contact five	stilpond now
	100	canadian decimal	six one	three five	contact now	stilpond	terminal	one	two	five
		callsign "contact"			destination				frequency	

FRAME : POE
Messages issued by : pseudo-pilot.

Trscr.	msg no.	Content of message								
1a	44	two roger	five	one	five	air	canada	nine	five	one
	46	two bravo	five good	one day	five	november	nine	zero	zero	papa
	93	two roger	five	one	five	air	france	zero	three	one
	95	lufthansa	four	seven	one	one	two	five	one	five
2a	18	two roger	five	one	five	air	canada	nine	five	one
	35	one papa	two bravo	five	one	five	november	nine	zero	zero
	74	two good	five day	one	five	air	france	zero	three	one
	76	two	five	one	five	lufthansa	four	seven	one	
	101	two	five	one	five	canadian	six	three		
		frequency		callsign				"roger"	"good"	"day"

FRAME : CH
Messages issued by : trainee controller or pseudo-pilot.

Trscr.	msg no.	Content of message								
2a	70	town center	center	air	canada	eight	five	seven	go	ahead
		center		callsign				"go"	ahead"	

FRAME : SB
Messages issued by : trainee controller or pseudo-pilot.

Trscr.	msg no.	Content of message				
2a	49	canadian	six	three	center	standby
			callsign			"standby"

FRAME : SIO
Messages issued by : pseudo-pilot.

Trscr.	msg no.	Content of message								
1a	22	town	lufthansa	four	seven	one	your	frequency	flight	level
		two	eight	zero						
	24	town	center	air	france	zero	three	one	with	you
		flight	level	two	six	zero				
	71	midtown	air	canada	eight	five	seven	your	frequency	flight
		level	two	eight	zero					
	73	town	canadian	six	three	with	you	level	two	six
		zero								
2a	16	town	center	lufthansa	four	seven	one	your	frequency	flight
		level	two	eight	zero					
	20	midtown	air	france	zero	three	one	your	frequency	flight
		level	two	six	zero					
	48	midtown	canadian	six	three	your	frequency	flight	level	two
		six	zero							
	57	town	center	canada	eight	five	seven	flight	level	two
		eight	zero	your	frequency					
	59	midtown	alitalia	six	six	five	with	you	flight	level
		three	one	zero						
		*****	*****	*****	*****	*****	*****	*****	*****	*****
		center	callsign	"with"	"you"	"your"	"frequency"	"flight"	"level"	altitude

FRAME : K
Messages issued by : trainee controller or pseudo-pilot

Trscr.	msg no.	Content of message								
1a	10	november	nine	hundred	papa	bravo	center	roger		
	15	november	nine	zero	zero	papa	bravo	roger		
	23	*****	four	seventy-one		center	roger			
	25	air	france	zero	three	one	center	roger		
	55	lufthansa	four	seventy-one		center	roger	...		
	72	air	canada	eight	fifty	seven	mooselakeiiiii		air	euh
		midtown	center	roger						
	74	canadian	six	three	midtown	center	roger			
	76	air	france	zero	iiiii	thirty-one		check	your	level
		one	two	thousand						
	80	lufthansa	four	seven	one	center	roger			
	103	alitalia	six	six	five	center	roger	...		
(from a/c)	108	canada	eight	five	seven	roger				
	112	air	canada	eight	fifty-seven		center	roger		
2a	4	november	nine	zero	zero	papa	bravo	roger		
	6	air	canada	nine	five	one	center	roger		
	19	lufthansa	midtown	center	lufthansa	four	seven	one	midtown	center
		roger								
	21	air	france	zero	three	one	center	roger		
	40	lufthansa	four	seven	one	center	roger			
	42	air	france	zero	three	one	center	roger		
	56	canadian	six	three	center	roger				
	58	air	canada	eight	five	iiiii	seven	center	roger	
	60	alitalia	six	six	five	midtown	center	roger		
	81	alitalia	six	six	five	roger				
	87	alitalia	six	six	five	roger				
	89	midtown	to	*****	eight	five	seven	roger		
	95	air	canada	eight	five	seven	center	roger		
		*****	*****	*****	*****	*****	*****	*****	*****	*****
			callsign			center		"roger"		"to"

FRAME : OC
Messages issued by : trainee controller or pseudo-pilot.

Trscr.	msg no.	Content of message					
2a	69	air	canada	eight	five	seven	center
		*****	*****	*****	*****	*****	*****
			callsign				center

APPENDIX E : Summary of frames and subframes for simple exercises

Frame :	HDR	HDD	VRD	VSD	ALDF
Slot 1: call.	callsign	callsign	callsign	callsign	callsign
Slot 2: keywords	"say your heading"		"vectors to re-intercept the airway on course"	"vectors for spacing"	
Slot 3: posit.			position		
Slot 4: keywd.		"turn"	"turn"	"turn"	
Slot 5: side		side	side	side	
Slot 6: keywd. for heading		"heading"	"heading"	"on a heading of"	
Slot 7:heading		heading		heading	
Slot 8:heading to reintercept			heading to reintercept		
Slot 9: keywords for next altitude					"descend to maintain"
Slot 10: next altitude					altitude
Slot 11:keywds for altim. ref.					"Stilpond altimeter"
Slot 12:altim. reading					alt. reading
Slot 13:keywds for destination					
Slot 14: destination					
Slot 15:freq.					
Chap 16: keywords			"resume maintain normal navigation on-course"		
Slot 17:keywds for follow-up action					"report leaving"
Slot 18:altit. to be reported					altitude to be reported

Notes: The words between quotes are terminal elements (e.g. elements that cannot be decomposed any further). The other words are non-terminal elements and refer to subframes that must be instantiated.

Frame :	ALD	ALR	POD	X	OC	SB
Slot 1: calls.	callsign	callsign	callsign	callsign	callsign	callsign
Slot 2: keywords		"say your altitude"		"center roger to"	"center"	"standby"
Slot 3: posit.						
Slot 4: keywd.						
Slot 5: side						
Slot 6: keywd. for heading						
Slot 7:heading						
Slot 8:heading to reintercept						
Slot 9: keywords for next altitude	"maintain"					
Slot 10: next altitude	altitude					
Slot 11:keywds for altim. ref.	"Stilpond altimeter"					
Slot 12:altim. reading	alt. reading					
Slot 13:keywds for destination			"contact"			
Slot 14: destination			destination			
Slot 15:freq.			frequency			
Chap 16: keywords			"at"			
Slot 17:keywds for follow-up action						
Slot 18:altit. to be reported						

Notes: The words between quotes are terminal elements (e.g. elements that cannot be decomposed any further). The other words are non-terminal elements and refer to subframes that must be instantiated.

List of subframes for simple exercises:

```
Subframe:  callsign

Slot 1:        "november
                nine
                zero
                zero
                hundred
                papa
                bravo"

Slot 2:        "air
                canada
                nine
                five
                one"

Slot 3:        "Lufthansa
                four
                seven
                seventy
                one"

Slot 4:        "Air
                France
                zero
                three
                one"

Slot 5:        "Alitalia
                six
                six
                sixty
                five"

Slot 6:        "Air
                Canada
                eight
                five
                fifty
                seven"

Slot 7:        "Canadian
                six
                sixty
                three"
```

```
Subframe:          side

Slot 1:              "left"

Slot 2:              "right"
```

```
Subframe:          heading

Slot 1:              "zero
                      one
                      two
                      three"

Slot 2:              "zero
                      one
                      two
                      three
                     four
                      five
                      six
                      seven
                      eight
                      nine
                      niner"

Slot 3:              "zero
                      one
                      two
                      three
                      four
                      five
                      six
                      seven
                      eight
                      nine
                      niner"
```

```
Subframe:  center

Slot 1:          "midtown"

Slot 2:          "Mooselake"

Slot 3:          "Avalanche"

Slot 4:          "Eastview"

Slot 5:          "tower"
Slot 6:          "Stilpond
                  terminal"
```

```
Subframe:  altim. ref.

Slot 1:          "Stilpond"
```

```
Subframe:  altim. read.
Slot 1:          "two
                  three"

Slot 2:          "zero
                  one
                  nine
                  niner"
Slot 3:          "zero
                  one
                  two
                  three
                  four
                  five
                  six
                  seven
                  eight
                  nine
                  niner"

Slot 4:          "zero
                  one
                  two
                  three
                  four
                  five
                  six
                  seven
                  eight
                  nine
                  niner"
```

```
Subframe:  heading to reintercept
Slot 1:          "zero
                  one
                  two
                  three"

Slot 2:          "zero
                  one
                  two
                  three
                  four
                  five
                  six
                  seven
                  eight
                  nine
                  niner"
Slot 3:          "zero
                  one
                  two
                  three
                  four
                  five
                  six
                  seven
                  eight
                  nine
                  niner"
```

```
Subframe:  next altitude

Slot 1:          in-feet

Slot 2:          in-fl-level


Subframe:  in-feet

Slot 1:          "one
                  two
                  three"

Slot 2:          "zero
                  one
                  two
                  three
                  four
                  five
                  six
                  seven
                  eight
                  nine
                  niner"

Slot 3:          "thousand
                  feet"
```

```
Subframe:                 in-fl-level

Slot 1:                     "flight
                             level"

Slot 2:                     "one
                             two
                             three"

Slot 3:                     "zero
                             one
                             two
                             three
                             four
                             five
                             six
                             seven
                             eight
                             nine
                             nines"
```

```
Subframe:  altitude to be reported

Slot 1:          in-feet

Slot 2:          in-fl-level
```

```
Subframe:  in-feet

Slot 1:          "one
                  two
                  three"

Slot 2:          "zero
                  one
                  two
                  three
                  four
                  five
                  six
                  seven
                  eight
                  nine
                  nines"

Slot 3:          "thousand
                  feet"
```

```
Subframe:  in-fl-level

Slot 1:         "flight
                 level"

Slot 2:         "one
                 two
                 three"

Slot 3:         "zero
                 one
                 two
                 three
                 four
                 five
                 six
                 seven
                 eight
                 nine
                 niner"
```

APPENDIX F : Assignment of ratings

Element "callsign" : This element will not change as the callsign assigned to a given aircraft remains the same for the duration of an exercise.

Element "next sector" : So far, this element is mentioned only when handing off an aircraft to an adjacent sector. The scenario specifies from which sector the aircraft originates, which sector it will be crossing and to which sector it will be handed off. Therefore, two sources of information exist : the message and the scenario of the exercice.

Element "altitude : next" : The next altitude that will be assigned to an aircraft is not known by the pilot in advance. The message is then the source of information concerning this element. A local syntax can however be used.

Element "heading : next" : The next heading(s) that will be assigned to an aircraft is (are) not known by the pilot in advance. The message is then the source of information concerning this element. A local syntax can however be used.

Element "position : current" : At any time, a marker representing the aircraft appears on the radar display. Two sources of information can then be used : the message and the simulation computer.

Element "altimeter info. " : This element is part of the scenario. Two sources of information exist concerning this element : the message and the scenario.

APPENDIX G : Analysis of the error recovery process

REQUESTS FOR REPETITION :

Messages issued by trainee controller :

Transcr. no.	Msg	Content							
1a	78	*****			can	you	say	again	
3a	32	aircraft calling	terminal				say	again	
4a	188	aircraft calling	*****		can	you	say	again	

Pattern : RECIPIENT ---> CAN YOU SAY AGAIN

Messages issued by pseudo-pilot :

Transcr. no.	Msg	Content											
4a	222	Ascot	five	four	five	two	say	again	altitude				
	241	Canadian three tango	one NDB	leaving turning	one left	two to	two	thousand intercept	for	four say	thousand feet again	clearancefor heading	
	264	Ascot	five	four	five	two	roger	turning	right	sorry	say	again	heading

SELF-CORRECTION IN SAME MESSAGE :

Messages issued by trainee controller :

Transcr. no.	Msg	Content											
1a	83	Canadian	six	three	disregardmaintain		heading	three	five	five			
2a	71	Air of	Canada three	eight five	five five	seven	vectors	for correction		spacing heading	turn right zero three	on five	4 heading
3a	7	Canforce	five	four	zero	four	midtown	correctionStilpond			terminal	roger	
3a	21	foxtrot	hotel	sierra	correctionfoxtrot		sierra	hotel	alpha		Stilpond	terminal ...	
3a	35	correctionterminal		roger									
3a	99	...	turn	right	correctionturn		left	heading	two	zero	zero		
3a	101	november flight	three level	one one	zero eight	echo zero	lima	flight	level	one	correction		maintain
3a	132	foxtrot	whiskey	correctionwhiskey		tango	terminal ...						
3a	137	golf Stilpond	sierra altimeterthree	uniform	november stilpond		terminal	roger	Stilpond	terminal		correction	
3a	160	golf straight-in	sierra localiser	uniform back	november *****		... course	for	4 ...	localizer		correction	
3a	172	foxtrot	x-ray	whiskey	tango	contact	iiiii	correctionEastview		center		one	three
3a	223	...	fifteen	miles	correctionseventeenmiles			from	the		threshold...		

Pattern : SEMANTIC BLOCK --> "CORRECTION" --> CORRECTED SEMANTIC BLOCK 71-7-21-99-132-223

INCOMPLETE SEMANTIC BLOCK --> "CORRECTION" --> COMPLETE SEMANTIC BLOCK

INCOMPLETE WORD ->"CORRECTION" --> COMPLETE WORD

IDENTIFICATION AND RESOLUTION OF AMBIGUITY

Transcr.	Series of msg	Content											
1a	3	...	turn	right	heading	zero	three	five					
	4		confirm	right	zero	three	five	for	november	zero	zero	papa	bravo
	5		confirm	zero	three	five							
	6		roger										
	35	...	turn	right	heading	zero	three	five	...				
	36	confirm	right	to	zero	three	five	for	Lufthansafour			seven	one
	47	*****	Lufthansa*****										
	48	I	asked	*****	to	confirm	the	turn	*****				
	49	zero	three	five									
	50	roger											
2a	82	...	turn	left	heading	three	five	five	to	reintercept	the	airway	
	83	Air	Canada	eight	five	seven	left	three	five	five	I	don't	
		think	we'll	intercept	an	that	heading						
	84	Air	Canada	eight	five	seven	turn	left	heading	three	one	five	
	85	Canada	eight	five	seven	left	on	three	one	five	to	intercept	
		roger											
4a	42	fourone	india	oscar	golf	confirm	you-re	through	seven				
	43	negative	will	call	at	seven	thousand	for	four		thousand		
		oscar	i-m	at	nine	thousand					thousand	india	
	44	india	oscar	golf	roger								
	193	golf	alpha	romeo	oscar	turn	right	heading	two	seven	zero	maintain	
		eight	thousand										
	194	alpha	romeo	oscar	turn	right	heading	two	seven	zero	maintain *****		
		four	thousand	confirm									
	195	negative	maintain	eight	thousand								
	258	Nordair	two	six	two	...							
	259	confirm	that	for	Norontair	two	six	two	...				
	260	Nordair	two	six	two	roger	...						
		!	!	!	!	!	!	!	!				
	261	Can	you	change	that	in	Norontair						
	262	right	or	whatever	you	say	Nordair						

Pattern : SEMANTIC BLOCK -> CONFIRM
SEMANTIC BLOCK --> CONFIRM SEMANTIC BLOCK
OR
--> (NEGATIVE OR CORRECTION) SEMANTIC BLOCK

APPENDIX H : Transcipts of complex exercises

Transcript: IFR, terminal exercise, ID= 3a

Notes:
A message issued by a trainee controller is preceded by C=.
A message issued by the pseudo-pilot is preceded by P=.
A message issued by another control center is preceded by Other-center or the other center name.
A *** signals a phrase fragment that has not been identified.**
A iiiii signals a word that has been incompletly pronounced.

Stilpond= Stilpond Eastview handoff Stilpond zero nine two *****

Stilpond terminal= go ahead this is terminal

Stilpond= eight east of the boundary on the Stilpond zero nine two i-ve got two for you first Canforce five four zero four level eight thousand colocated with Foxtrot India Oscar Golf one zero thousand

Stilpond terminal= Canforce five four zero four and Foxtrot India Oscar Golf identify are identified Victor Mike and could i get control of Foxtrot India Oscar Golf

Eastview= Foxtrot India Oscar Golf your control

P= Stilpond terminal Canforce five four zero four your frequency level eight thousand

Stilpond terminal= Canforce five four zero four midtown correction Stilpond terminal roger

Stilpond terminal= Canforce five four zero four Stilpond altimeter three zero zero zero

P= three zero zero zero Canforce five four zero four roger

P= Stilpond Foxtrot India Oscar Golf with you one zero thousand

Stilpond terminal= Foxtrot India Oscar Golf Stilpond terminal roger cleared to the Tango NDB vectors to the final approach course turn right heading two niner zero

P= ***** cleared Tango NDB right turn two nine zero India Oscar Golf roger

Stilpond terminal= and India Oscar Golf Stilpond altimeter three zero zero zero

P= check three zero zero zero India Oscar Golf roger

Eastview= Stilpond Eastview handoff Stilpond zero nine two *****

Stilpond terminal= go ahead this is Stilpond

Eastview= seven east of the boundary on the Stilpond zero nine two Foxtrot Sierra Hotel Alpha level eight thousand

Stilpond terminal= Foxtrot Sierra Hotel Alpha is identified and we request control

Eastview= Sierra Hotel Alpha your control

P= Stilpond terminal Foxtrot Sierra Hotel Alpha your frequency level eight thousand

Stilpond terminal= Foxtrot Hotel Sierra correction Foxtrot Sierra Hotel Alpha Stilpond terminal roger cleared to the Tango NDB vectors for the final approach course turn right heading two niner zero maintain eight thousand Stilpond altimeter three zero zero zero

P= check three zero zero zero Hotel Alpha cleared to Tango NDB and right turn heading two nine zero maintain present altitude

Stilpond terminal = Foxtrot India Oscar Golf maintain seven thousand

P= Foxtrot Golf leaving one zero thousand for seven roger

Stilpond terminal= Foxtrot Sierra Hotel Alpha maintain seven thousand

P= ***** Hotel Alpha= leaving eight for seven roger

Stilpond terminal= Tower terminal sequence

Tower= tower go ahead

Stilpond terminal= ten miles north east of the airport is Foxtrot India Oscar Golf number one twenty miles east of the airport is Foxtrot Sierra Hotel Alpha number two

Tower= Fox India Oscar Golf and Foxtrot Hotel Alpha roger

P= Stilpond Hotel Alpha level seven thousand

Stilpond terminal= aircraft calling terminal say again

P= terminal Sierra Hotel Alpha level level seven thousand

Stilpond terminal= Sierra Hotel Alpha center roger

Stilpond terminal= correction terminal roger

Stilpond terminal= Foxtrot India Oscar Golf turn right heading two niner five

P= right two nine five Oscar Golf roger

Stilpond terminal= Foxtrot Sierra Hotel Alpha turn right heading two niner five

P= Hotel Alpha in the right turn two nine five roger

Tower= terminal tower

Stilpond terminal= go ahead

Tower= Foxtrot Sierra India Mike is taxiing

Stilpond terminal= Foxtrot Sierra India Mike clearance is valid

Tower= roger

P= terminal India Oscar Golf level seven thousand

Stilpond terminal= India Oscar Golf roger

Stilpond terminal = Foxtrot India Oscar Golf maintain four thousand

P= Oscar Golf leaving seven for four roger

Stilpond terminal = Foxtrot Sierra Hotel Alpha maintain four thousand

P= terminal Hotel Alpha leaving seven for four

Stilpond terminal = Foxtrot India Oscar Golf eight miles north west of Tango twelve miles from touch down turn left heading two zero zero

P= left two zero zero Oscar Golf roger

P= and terminal Oscar Golf level four thousand
Stilpond terminal= Oscar Golf roger

Tower= terminal tower Foxtrot Sierra India Mike off at one five

Stilpond terminal= India Mike off at one five

P= Stilpond Sierra Hotel Alpha level four thousand

Stilpond terminal= Hotel Alpha roger

Tower= and terminal tower

Stilpond terminal= go ahead this is terminal

Tower= i-ve got two more taxiing first November three one zero Echo Lima followed by Foxtrot X-ray Whiskey Tango

Stilpond terminal= November three one zero Echo Lima and Foxtrot X-ray Whiskey Tango ***** check taxiing

P= Stilpond terminal Foxtrot Sierra India Mike your frequency on departure out of four for six

Stilpond terminal= Foxtrot Sierra India Mike Stilpond terminal radar identified maintain one six thousand through five thousand turn right heading two three zero

P= India Mike we-re just passing through five now i-ll climb to one six thousand and right turn heading two three zero

Stilpond terminal= Eastview terminal handoff Stilpond three one one

Eastview= Eastview go ahead

Stilpond terminal= Seven miles from correction seven miles south of the boundary on the three one one radial Canforce five four zero eight level eight thousand victor mike

Eastview= you wanna go ahead on that again i-ve got a Canforce five four zero four

Stilpond terminal= that-s Canforce five four zero four victor mike

Eastview= Canforce five four zero four identified *****

Stilpond terminal= Foxtrot India Oscar Golf cleared to the Stilpond airport for a straight in localizer back course runway one one approach to intercept localizer turn left heading one four zero
P= left one four zero to intercept the localizer cleared to straihgt in the back course one one Oscar Golf roger

Stilpond terminal= Canforce five four zero four contact Eastview center two five two decimal seven now good day

P= five two seven Canforce five four zero four roger

Tower= terminal tower

Stilpond terminal= go ahead this is terminal

Tower= November three one zero Echo Lima ready for departure

Stilpond terminal= November three one zero Echo Lima clearance is valid

Tower= roger

Stilpond terminal= Alpha Sierra India Mike report leaving niner thousand

P= India Mike i-m at nine thousand now

Stilpond terminal= Alpha Sierra India Mike roger

Stilpond terminal= Avalanche terminal handoff Stilpond

Avalanche= Avalanche go ahead

Stilpond terminal= five miles south of Stilpond on a heading of two three zero is Foxtrot Sierra India Mike through niner thousand for one six thousand

Avalanche= Foxtrot Sierra India Mike identified *****

Stilpond center- Foxtrot Sierra India Mike contact midtown center one three two decimal three five now

P- three two three five India Mike

Tower- terminal tower November three one zero Echo Lima off at two two one nine

Stilpond terminal- November three one zero Echo Lima off at two two one nine Victor Mike

P- Stilpond terminal November three one zero Echo Lima on departure ***** ***** six

Stilpond terminal- November three one zero Echo Lima maintain one one thousand through five thousand turn right heading two zero zero

P- November three one zero Echo Lima cleared to one one thousand at five right turn to heading two zero zero roger

Stilpond terminal- and Echo Lima report leaving niner thousand

P- three one zero Echo Lima call you through nine roger

Stilpond thousand- Foxtrot India Oscar Golf contact tower one one niner decimal niner now

P- nineteen nine Oscar Golf

Stilpond terminal- Foxtrot Sierra Hotel Alpha ten miles north west of Tango fifteen miles from touchdown turn right correction turn left heading two zero zero

P- left zero zero Sierra Hotel Alpha roger

Stilpond terminal- November three one zero Echo Lima flight level one correction maintain flight level one eight zero

P- cleared to flight level one eight zero November three one zero Echo Lima roger

Tower- terminal tower

Stilpond terminal- go ahead this is terminal

Tower- Foxtrot X-ray Whiskey Tango ready for departure

Stilpond terminal= Foxtrot X-ray Whiskey Tango clearance is valid

Tower= roger

Tower= Terminal tower Foxtrot X-ray Whiskey Tango off at two two two one

Stilpond terminal= X-ray Whiskey Tango off at two two two one Victor Mike

P= Stilpond terminal euh November three one zero Echo Lima through niner thousand

Stilpond terminal= November three one zero Echo Lima terminal roger

Stilpond terminal= Avalanche terminal handoff Stilpond

Avalanche= Avalanche go ahead

Stilpond terminal= five miles south south east of the Stilpond VORTAC is November three one zero Echo Lima through niner thousand for one for flight level one eight zero Victor Mike

Avalanche= November three one zero Echo Lima identified *****

Stilpond terminal= and he-ll be on a heading of two four zero

Avalanche= roger

Stilpond terminal= November three one zero Echo Lima turn right heading two four zero contact iiiii contact midtown center one three two decimal three five now good day

P= three one zero Echo Lima in the right turn heading two four zero switching one three two three five good day

P= Stilpond terminal Foxtrot X-ray Whiskey Tango your frequency on departure out of four for six

Stilpond terminal= Whiskey Tango terminal radar identified euh maintain seven thousand

P= Whiskey Tango cleared to seven roger out of four thousand five hundred now

Stilpond terminal= Foxtrot Sierra Hotel Alpha turn left heading one four zero

P= left one four zero Hotel Alpha

Stilpond terminal= then Foxtrot Sierra Hotel Alpha cleared to the Stilpond airport for a straight-in localizer back course runway one one approach

P= cleared to straight-in localizer backhorse one one Sierra Hotel Alpha roger

Eastview= Stilpond Eastview handoff Stilpond three one one radial

Stilpond terminal= go ahead this is terminal

Eastview= three euh north west on the boundary on the Stilpond three one one radial Golf Sierra Uniform November level niner thousand

Stilpond terminal= Golf Sierra Uniform November is identified Victor Mike

Stilpond terminal= Foxtrot Whiskey correction Whiskey Tango terminal turn left heading zero three zero to intercept Victor seven

P= left zero three zero to intercept Victor seven Whiskey Tango roger

Stilpond terminal= Foxtrot Sierra Hotel Alpha contact midtown center correction contact Stilpond tower one one niner decimal niner now

P= switching to nineteen nine Sierra Hotel Alpha roger good day

P= Stilpond terminal Golf Sierra Uniform November your frequency level niner thousand

Stilpond terminal= Golf Sierra Uniform November Stilpond terminal roger Stilpond terminal correction Stilpond altimeter three zero zero zero

P= three zero zero zero Uniform November roger

Stilpond terminal= Eastview terminal request control on Golf Sierra Uniform November

Eastview= Golf Sierra Uniform November your control

Stilpond terminal= Golf Sierra Uniform November cleared to the Tango NDB radar vectors to intercept the final approach course turn right heading one four zero

P= to the Tango NDB right turn one four zero Uniform November roger

Stilpond terminal= and Uniform November maintain four thousand

P= Uniform November leaving nine for four roger

P= Stilpond X-ray Whiskey Tango level seven thousand

Stilpond terminal= X-ray Whiskey Tango terminal roger

Eastview= Stilpond Eastview handoff Stilpond zero five six radial

Stilpond terminal= go ahead this is terminal

Eastview= five from the boundary make that four north east of the boundary on the Stilpond zero five six Golf Alpha Romeo Oscar one zero thousand

Stilpond terminal= Golf Alpha Romeo Oscar is identified Victor Mike

Stilpond terminal= Golf Sierra Uniform November twenty miles north west of Tango twenty five miles from touchdown

P= roger

P = Stilpond terminal Golf Alpha Romeo Oscar your frequency one zero thousand

Stilpond terminal= Golf Alpha Romeo Oscar Stilpond terminal roger cleared to the Tango NDB vectors to the final approach course maintain heading maintain altitude Stilpond altimeter three zero zero zero

P= check three zero zero zero Romeo Oscar will maintain altitude

Stilpond terminal = tower terminal sequence

Tower= tower go ahead

Stilpond terminal= fifteen miles north west of the airport is Golf Sierra Uniform November number one twenty five miles north east of the airport is Golf Alpha Romeo Oscar number two

Tower= roger copy

Stilpond terminal= Golf Sierra Uniform November ***** interception of the localizer you-re cleared to the Stilpond airport for a localizer correction straight-in localizer back course for the one one approach

P= cleared in localizer back course one one Uniform November

Stilpond terminal= Uniform November say your altitude

P= Uniform November set at five thousand

Stilpond terminal= Golf Sierra Uniform November contact tower one one niner decimal niner now

P= nineteen nine Uniform November good day

Stilpond terminal= Golf Alpha Romeo Oscar turn right heading two seven zero

P= Alpha Romeo Oscar right turn two seven zero roger

Stilpond terminal= Eastview terminal handoff Stilpond

Eastview= Eastview go ahead

Stilpond terminal= fifteen miles north correction fifteen miles south west of the boundary on the zero five six radial is Foxtrot X-ray Whiskey Tango level seven thousand

Eastview= Foxtrot X-ray Whiskey Tango identified *****

Stilpond terminal= Victor Mike

Stilpond terminal= Foxtrot X-Ray Whiskey Tango contact iiiii correction Eastview center one three three decimal five now good day

P= one three three five Whiskey Tango roger

Stilpond terminal= Romeo Oscar maintain four thousand

P= Alpha Romeo Oscar leaving one zero thousand for four roger

Avalanche= Stilpond Avalanche handoff Stilpond one seven six radial

Stilpond terminal= go ahead this is terminal

Avalanche= ten south of the boundary on the Stilpond one seven six Oscar five four five two level one two thousand

Stilpond terminal= Ascot five four five two is identified and we request control

Avalanche= Ascot five four five two your control

P= Stilpond terminal Ascot five four five two your frequency level one two thousand

Stilpond terminal= Ascot five four five two Stilpond terminal roger cleared to the Tango NDB vectors to the final approach course turn left heading three three zero maintain six thousand

P= Ascot five four five two cleared to Tango NDB and left turn heading three three zero leaving one two thousand for six thousand roger

Stilpond terminal= Golf Alpha Romeo Oscar turn right heading two eight zero
P= right two eight zero Romeo Oscar

Stilpond terminal= Romeo Oscar eight miles north east of the Tango NDB twelve miles from the threshold turn left heading two zero zero

P= left two zero zero Alpha Romeo Oscar roger

Stilpond terminal= Romeo Oscar clear to the Romeo Oscar clear to the Stilpond airport for an straight-in localizer back course one one approach intercept localizer turn left heading one four zero

P= left one four zero to intercept clear to straight-in localizer back course one one Alpha Romeo Oscar roger

Stilpond terminal = and Romeo Oscar say your altitude

P= Romeo Oscar level at four

Avalanche= ***** Stilpond Avalanche ***** got one for you on the Stilpond one seven six

Stilpond terminal= go ahead this is terminal

Avalanche= two south of the boundary on the Stilpond one seven six radial Canadian three one one two thousand

Stilpond terminal= Canadian three one is identified and we request control

Avalanche= Canadian three one your control

P= Stilpond Ascot five four five two level six thousand

Stilpond terminal= Ascot five four five two terminal roger
P= Stilpond terminal Canadian three one your frequency one two thousand

Stilpond terminal= Canadian three one Stilpond terminal roger clear to the Tango NDB vectors to intercept the final approach course turn left heading three two iiiii three two zero maintain seven thousand

P= cleared to Tango iiiii Canadian three one cleared to Tango NDB leaving one two thousand for seven and left turn heading three two zero roger

Stilpond terminal= Golf Alpha Romeo Oscar contact Stilpond tower one one niner decimal niner now good day

P= nineteen nine Alpha Romeo Oscar

Avalanche= Avalanche Eastview handoff Stilpond zero nine two radial

Stilpond terminal= go ahead this is terminal

Eastview= eight east of the boundary on the Stilpond zero nine two Norontair two six two level one zero thousand

Stilpond terminal= Norontair two six two is identified Victor Mike

Stilpond terminal= tower terminal sequence

Tower= tower go ahead

Stilpond terminal= ten south west of the airport is Ascot five four five two number one twenty miles south of the airport is Canadian three one number two

Tower= check Ascot five four five two followed by Canadian three one roger

tower= and terminal tower

Stilpond terminal= go ahead

Tower= I-ve got two taxiing for you first Canforce three two three followed by Golf Romeo Charlie Oscar

Stilpond terminal= Canforce three two three is valid and will ***** call you for Charlie Oscar Victor Mike

Stilpond terminal= Ascot five four five two maintain four thousand

P= Ascot five four five two leaving six for four roger

P= Stilpond terminal Norontair two six two your frequency one zero thousand

Stilpond terminal= Norontair two six two Stilpond terminal roger Stilpond altimeter three zero zero zero

P= check three zero zero zero Norontair two six two roger

Stilpond terminal= and Canadian three one maintain four thousand

P= Canadian three one leaving just leaving seven now for four roger

Stilpond terminal= Ascot five four five four west of the Tango NDB fifteen miles correction seventeen miles from the threshold turn right heading two zero zero

Stilpond terminal= Ascot five four five two correction turn right heading zero two zero

P= Ascot five four five two right to a heading of zero two zero roger and we-ll check our level at four this time

Eastview= Stilpond Eastview handoff Stilpond zero nine two radial

Stilpond terminal= go ahead this is terminal

Eastview= six east of the boundary on the Stilpond zero nine two Foxtrot November Whiskey Foxtrot level eight thousand

Stilpond terminal= Foxtrot November Whiskey Foxtrot is identified Victor Mike

Stilpond terminal= Ascot five four five two cleared to the Stilpond airport for a straight-in localizer back course runway one one approach turn right heading zero eight zero to intercept localizer

P= right turn heading zero eight zero to intercept the localizer cleared to straight-in localizer back course one one Ascot five four five two roger

P= Stilpond terminal Foxtrot November Whiskey Foxtrot your frequency level eight thousand

Stilpond terminal= Foxtrot November Whiskey Foxtrot Stilpond terminal roger Stilpond altimeter three zero zero zero

P= Whiskey Foxtrot check three zero zero zero

Stilpond terminal= and Whiskey Foxtrot cleared to the Tango NDB vectors to the final approach course maintain present heading maintain present altitude

P= Whiskey Foxtrot cleared to Tango NDB present heading and altitude roger

P= Stilpond Canadian three one level four thousand

Stilpond terminal= Canadian three one roger

Stilpond terminal= Eastview terminal request control of Foxtrot November Whiskey Foxtrot
Eastview= November Whiskey Foxtrot your control

Stilpond terminal= Victor Mike

Stilpond terminal= Whiskey Foxtrot turn right heading two niner zero

P= Whiskey Foxtrot turning right heading two nine zero roger

Tower= terminal tower

Stilpond terminal= go ahead

Tower= Canforce three two three is off at two two four five

Stilpond terminal= Canforce three two three off at two two four five Victor Mike

P= Stilpond terminal Canforce three two three your frequency airborne this time instead of two thousand ***** climb to six

Stilpond terminal= Canforce three two three Stilpond terminal radar identified ***** position report through five thousand turn right heading two zero zero

P= Canforce three two three out of five right two zero zero confirm

Stilpond terminal= that-s affirmative right two zero zero maintain niner thousand

P= cleared to nine out of five right two zero zero Canforce three two three roger

**********fin du ruban**********

Transcript : IFR, terminal exercise, ID= 4a

Notes:
A message issued by a trainee controller is preceded by C=.
A message issued by the pseudo-pilot is preceded by P=.
A message issued by another control center is preceded by Other-center or the other center name.
A *** signals a phrase fragment that has not been identified.**
A iiiii signals a word that has been incompletly pronounced.

Eastview= Stilpond Eastview handoff on Stilpond zero nine two

Stilpond terminal= Eastview Stilpond terminal go ahead handoff

Eastview= zero nine two degree radial five miles east of the boundary we-ve got Canforce five four zero four level eight thousand colocated Foxtrot India oscar golf level one zero thousand

Stilpond Terminal= ok that-s Canforce five four zero four identified foxtrot india oscar golf radar identified and we request control of both aircraft *****

Eastview= both your control charlie charlie

Stilpond terminal= *****

P= Stilpond terminal Canforce five four zero four on frequency level eight thousand

Stilpond terminal= Canforce five four zero four Stilpond iiiii Stilpond altimeter three zero zero vectors for spacing turn right heading two nine zero

P= Canforce five four zero four turning right heading two niner zero

P= Stilpond terminal good morning Foxtrot india oscar golf on frequency now level one zero thousand

Stilpond terminal= Foxtrot india oscar golf Stilpond terminal Stilpond altimeter three zero zero zero

P= oscar golf

Stilpond terminal= foxtrot india oscar golf cleared to the tango NDB vectors to the final approach course maintain one zero thousand maintain present heading

P= foxtrot india oscar golf maintain present heading one zero thousand ***** tango

Eastview= Stilpond Eastview handoff zero nine two degrees radial

Stilpond terminal= Eastview Stilpond terminal go ahead

Eastview= ***** zero nine two degree radial seven miles east of the boundary foxtrot oscar hotel alpha eight thousand

Stilpond terminal= foxtrot oscar hotel alpha radar identified *****

Eastview= charlie charlie

Stilpond terminal= foxtrot india oscar golf turn right heading two nine zero

P= foxtrot india oscar golf turning right heading two niner zero

P= ***** check ***** hotel alpha eight thousand

Stilpond terminal= foxtrot sierra hotel alpha Midtown center Stilpond altimeter three zero zero cleared to the tango NDB radar vectors to the final approach course maintain four thousand feet maintain present heading

P= sierra hotel alpha maintain four thousand feet leaving eight thousand now and present heading

Stilpond terminal= foxtrot sierra hotel alpha roger

Stilpond terminal= Canforce five four zero four turn right heading three zero zero

P= Canforce five four zero four turning right heading three zero zero

Stilpond terminal= Eastview Stilpond terminal

Eastview= go ahead

Stilpond terminal= foxtrot sierra hotel alpha three miles inside of boundary request control for vectors

Eastview= your control

Stilpond terminal= foxtrot sierra hotel alpha turn right heading two nine zero

P= sierra hotel alpha right turn two niner zero

Stilpond terminal= tower terminal point out

Tower= go

Stilpond terminal= three miles north east of ***** NDB is foxtrot india oscar golf he-ll be cutting north of your airspace in fifteen euh ten miles in trail of foxtrot sierra hotel alpha

Tower= ***** charlie

Stilpond terminal= foxtrot india oscar golf maintain four thousand

P= india oscar golf maintain four thousand i-m leaving one zero thousand now

P= Stilpond terminal foxtrot sierra hotel alpha level four thousand

Stilpond terminal= foxtrot sierra hotel alpha roger break foxtrot india oscar golf report leaving seven thousand

P= india oscar golf will call through seven thousand for four thousand

Stilpond terminal= foxtrot india oscar golf confirm you-re through seven thousand

P= negative will call at seven thousand for four thousand india oscar golf i-m at nine thousand

Stilpond terminal= india oscar golf roger

Tower= terminal tower

Stilpond terminal= tower terminal go ahead

Tower= foxtrot sierra india mike is taxiing

Stilpond terminal= check sierra india mike taxiing *****

Stilpond terminal= Canforce five four zero four turn left heading two nine zero to intercept Stilpond three one one degree radial upon intercept resume normal navigation

P= Canforce five four zero four turn left two niner zero to pick up the airway

Stilpond terminal= Canforce five four zero four roger

Stilpond terminal= tower terminal

Tower= terminal tower go

Stilpond terminal= foxtrot sierra hotel alpha there now approximately five miles north east of the ***** NDB he-ll be cutting now for the ***** north through your airspace

Tower= ***** charlie

P= Stilpond terminal foxtrot India oscar golf is through seven thousand for four thousand

Stilpond terminal= foxtrot india oscar golf roger

Stilpond terminal= foxtrot sierra hotel alpha turn right heading three zero zero

P= sierra hotel alpha turning right heading three zero zero

Stilpond terminal= Tower terminal

Tower= go

Stilpond terminal= restrict sierra hotel restrict sierra india mike to climb to localizer to three thousand

Tower= roger

Tower= and sierra india mike is ready to go

Stilpond terminal= stand-by one

Tower= roger

Stilpond terminal= foxtrot india oscar golf turn left heading two zero zero

P= india oscar golf turning left now left now heading two zero zero

Stilpond terminal= tower terminal

Tower= terminal tower go

Stilpond terminal= Sierra India Mike valid

Tower= Sierra India Mike is rolling two two one five

Stilpond terminal= foxtrot india oscar golf eight miles from the tango NDB twelve miles from the threshold turn left heading two heading one four zero to intercept final approach course upon intercept you-re clear to the airport first straight in back course runway one one approach

P= foxtrot india oscar golf left turn heading one four zero to intercept ***** to the airport straight in localiser back course runway one one approach

Stilpond terminal= foxtrot sierra hotel alpha turn right heading three one zero

P= sierra hotel alpha turning right heading three one zero

P= Stilpond terminal Foxtrot Sierra India mike is on your frequency climbing to three thousand

Stilpond terminal= Foxtrot Sierra India Mike roger maintain one one thousand upon leaving five thousand turn right heading two four zero report leaving nine thousand

P= Foxtrot Sierra india mike climb to one one thousand call through nine thousand ***** and when we-re out of five thousand cleared to the right turn to a heading of two four zero

Stilpond terminal= sierra india mike roger and check you-re radar identified

P= india mike

Tower= terminal tower

Stilpond terminal= go ahead tower

Tower= check november three one zero echo lima is taxiing

Stilpond terminal= taxiing

Tower= and too behind him foxtrot x-ray whiskey tango

Stilpond terminal= and x-ray whiskey tango

Stilpond terminal= and *****

Tower= say again

Stilpond terminal= what what was the out time on s i m

Tower= two two one six

Stilpond terminal= two two one six roger

Stilpond terminal= Foxtrot india oscar golf twelve miles from the tango NDB contact tower one one nine decimal nine now

P= india oscar golf calling tower one one nine decimal nine thanks

Stilpond terminal= foxtrot sierra hotel alpha turn left heading two three zero

P= sierra hotel alpha turning left heading two three zero

Tower= terminal tower

Stilpond terminal= go ahead terminal go ahead tower

Tower= november three one echo lima is *****

Stilpond terminal= *****

Stilpond terminal= foxtrot sierra india mike say your present altitude

P= sierra india mike is through six thousand five hundred for one one thousand

Stilpond terminal= three ***** echo lima is valid tower

Tower= roger

Stilpond terminal= foxtrot sierra hotel alpha amend your heading turn right heading two nine zero

P= sierra hotel alpha turning right heading two niner zero

Stilpond terminal= Eastview Stilpond terminal handoff Stilpond three one one degree radial

Eastview= go

Stilpond terminal= one ***** space on a heading of three zero zero to intercept Stilpond three one one degree radial Canforce five four zero four eight thousand

Eastview= Canforce five four zero four identified
Stilpond terminal= Canforce five four zero four contact Eastview center now one three three decimal five good day

P= ***** one three three decimal five now thanks

P= Stilpond terminal foxtrot sierra india mike is ***** at niner thousand now for one one thousand

Stilpond terminal= foxtrot sierra india mike roger

Stilpond terminal= foxtrot sierra india mike maintain one six thousand

P= ***** one six thousand

Tower= terminal tower

Stilpond terminal= go ahead tower

Tower= three one zero echo lima off two two one nine

Stilpond terminal= Avalanche terminal handoff

Avalanche= go

Stilpond terminal= three miles south south east of Stilpond VOR is foxtrot sierra india mike last report out of nine thousand to climb to one six thousand

Avalanche= foxtrot sierra india mike identified

Stilpond terminal= and he-s heading two four zero

Avalanche= roger

Stilpond terminal= Foxtrot sierra india mike contact Avalanche now one three two decimal three five

P= mike roger one three two three five now thanks

P= Stilpond terminal November three one zero echo lima on your frequency

Stilpond terminal= november three one zero echo lima center

Stilpond terminal= Stilpond iiiii say you-re identified say your present altitude

Stilpond terminal= November three ten ***** say your present altitude

P= november three one zero echo lima is out of five thousand for six thousand

Stilpond terminal= november three one ***** maintain flight level one eight zero turn right heading two iiiii two four zero

P= november three one zero echo lima climb to flight level one eight zero turning right heading two four zero

Tower= terminal tower

Stilpond terminal= foxtrot sierra hotel alpha turn left heading two zero zero

P= sierra hotel alpha turning left heading two zero zero

Stilpond terminal= November three ten echo lima report leaving nine thousand

P= echo lima is just set at niner thousand now

Stilpond terminal= three ten echo lima roger turn left heading two one zero

Stilpond terminal= foxtrot sierra hotel alpha seven miles from the tango NDB eleven miles from the threshold turn left heading two six zero to intercept the localizer upon intercept you-re clear to the airport for a straight in back course runway one one approach

Stilpond terminal= ***** check *****left ***** to a heading one four zero

P= ***** turn left heading one four zero to intercept the on course then we-re clear to the airport for a straight-in localizer back course one one on *****

Tower= terminal tower

Stilpond terminal= go ahead

Tower= foxtrot x-ray whiskey tango is ready to go

Stilpond terminal= stand by

Stilpond terminal= Avalanche terminal handoff

Avalanche= go

Stilpond terminal= ***** to Stilpond VOR is November three one zero foxtrot echo lima headed to two one zero climbing to one eight thousand flight level one eight zero

Avalanche= November three one zero echo lima identified

Stilpond terminal= November three one zero echo lima contact midtown center now one three two decimal three five

P= ***** echo lima one three two three five

Stilpond terminal= tower terminal x-ray whiskey tango is valid

Tower= roger

Stilpond terminal= foxtrot sierra hotel alpha four miles from tango NDB contact tower now one one nine decimal nine good day

P= sierra hotel alpha one one nine decimal nine

Eastview= Stilpond Eastview handoff on the Stilpond three one one degree radial

Stilpond terminal= Eastview Stilpond terminal go ahead handoff

Eastview= three one one degree radial three miles north west of the boundary golf sierra uniform november niner thousand

Stilpond terminal= golf sierra uniform november radar identified request control for vectors

Eastview= your control charlie charlie

Stilpond terminal= *****

Tower= terminal tower x-ray whiskey tango up two two two four

Stilpond terminal= two two two four *****

P= Stilpond terminal golf sierra uniform november is on your frequency level niner thousand

Stilpond terminal= golf sierra uniform november Stilpond terminal roger Stilpond altimeter three zero zero zero clear to the tango NDB radar vectors to intercept the final approach course maintain nine thousand maintain present heading

P= november roger maintain niner thousand present heading

P= Stilpond terminal x-ray whiskey tango is with you i-m climbing to six thousand

Stilpond terminal= x-ray whiskey tango radar identified maintain seven thousand feet upon leaving five thousand turn left heading zero two zero

P= x-ray whiskey tango climb to seven thousand out of five thousand left turn heading zero two zero

Stilpond terminal= iiiii

Stilpond terminal= golf sierra uniform november maintain four thousand

P= golf sierra uniform november maintain four thousand leaving niner thousand

Eastview= Stilpond Eastview handoff on the Stilpond zero five six degree radial

Stilpond terminal= Eastview Stilpond terminal go ahead your handoff

Eastview= five miles from the boundary golf alpha romeo oscar level one zero thousand

Stilpond terminal= golf alpha romeo oscar radar identified *****

Eastview= charlie charlie

Stilpond terminal= x-ray whiskey tango on your heading to zero two zero intercept Stilpond zero five six degree radial resume normal navigation

P= x-ray whiskey tango roger on our present heading to intercept thanks

P= Stilpond terminal good morning golf alpha romeo oscar on your frequency level one zero thousand

Stilpond terminal= golf alpha romeo oscar iiiii Stilpond terminal roger Stilpond altimeter three zero zero clear to the tango NDB vectors to the final approach course maintain present heading

P= alpha romeo oscar ***** tango present heading present altitude

Stilpond terminal= tower terminal pointout sequence

Tower= go

Stilpond terminal= twenty miles from the terminal iiiii twenty miles north west of the terminal is golf sierra uniform november he-11 be number one for approach twenty five miles north east of the terminal just inside the boundary is golf alpha romeo oscar he-11 be number two for approach *****

Tower= charlie charlie

P= Stilpond terminal foxtrot x-ray whiskey tango level seven thousand now established on the airway

Stilpond terminal= aircraft calling ***** can you say again

P= this is x-ray whiskey tango calling in level seven thousand

Stilpond terminal= x-ray whiskey tango roger

Stilpond terminal= Golf sierra uniform november ten miles west of the tango NDB fourteen miles from the threshold turn right heading one four zero to intercept final approach upon interception of the final approach course clear for straight in back course runway one one approach

P= sierra uniform november right turn heading one four zero to intercept and on the intercept ***** cleared to the airport straight in localizer back course one one

Stilpond terminal= golf alpha romeo oscar turn right heading two seven zero maintain eight thousand

P= alpha romeo oscar turn right heading two seven zero maintain ***** four thousand confirm

Stilpond terminal= negative maintain eight thousand

P= roger maintain eight thousand leaving one zero thousand alpha romeo oscar

P= alpha romeo oscar level eight thousand

Stilpond terminal= alpha romeo oscar roger

Stilpond terminal= sierra uniform november four miles from tango NDB contact tower one one nine decimal nine now good day

P= ***** one one nine decimal nine now thanks

Stilpond terminal= Avalanche Stilpond terminal request control of Ascot five four five two

Avalanche= your control

Avalanche= and i-ve got a handoff for you on him

Stilpond terminal= go ahead

Avalanche= on the Stilpond one seven six degrees radial six miles correction five miles south of the boundary is Ascot five four five two he-s level one two thousand your control

Stilpond terminal= Ascot five four five two roger radar identified

P= Stilpond terminal Ascot five four five two on your frequency now level one two thousand

Stilpond terminal= Ascot five four five two roger Stilpond altimeter three zero zero turn check clear to the tango NDB vectors to the final approach course maintain present altitude turn left heading three two zero

P= Ascot five four five two turning left heading three two zero maintain one two thousand

Stilpond terminal= Eastview Stilpond terminal handoff Stilpond zero five six degree radial

Eastview= go ahead

Stilpond terminal= ten miles from the boundary is x-ray whiskey tango flight level check at seven thousand

Eastview= x-ray whiskey tango identified

Stilpond terminal= *****

Stilpond terminal= foxtrot x-ray iiiii x-ray whiskey tango contact Eastview now one three three decimal five good day

P= x-ray whiskey tango one three three decimal five good day

Stilpond terminal= tower this is terminal pointout sequence

Tower= go

Stilpond terminal= twenty miles of the VOR is Ascot five four five two he-ll be number two and behind golf alpha romeo oscar

Tower= charlie charlie

Stilpond terminal= Ascot five four five two maintain four thousand

P= Ascot five four five two maintain say again altitude

Stilpond terminal= Ascot five four five two four thousand

P= Ascot five four five two roger maintain four thousand leaving one two thousand

Stilpond terminal= golf alpha romeo oscar turn left heading two zero zero

P= alpha romeo oscar left turn heading two zero zero

Avalanche= Stilpond Avalanche handoff on the Stilpond one seven six degrees radial

Stilpond terminal= Avalanche terminal go ahead

Avalanche= Stilpond one seven six six miles from the boundary Canadian three one one two thousand

Stilpond terminal= Canadian three one radar identified *****

Avalanche= roger

P= Stilpond terminal good morning Canadian three one with you level one two thousand

Stilpond terminal= Canadian three one standby golf alpha romeo oscar turn left heading one four zero to intercept the localizer

P= alpha romeo oscar left heading one four zero to intercept the localizer

Stilpond terminal= golf alpha romeo oscar roger seven miles from the tango NDB eleven miles from the threshold upon intercept of the localizer clear to the airport for a straight in back course runway one one approach

P= alpha romeo oscar on the intercept clear to the airport for a straight in back course runway one one thanks

Stilpond terminal= golf alpha romeo alpha ***** to intercept localizer

P= alpha romeo oscar is ***** a little bit we-re just in the left turn to pick it up again

Stilpond terminal= roger

Stilpond terminal= Canadian three one Stilpond altimeter three zero zero zero tango clear to the tango NDB radar vectors to the final approach course maintain four thousand feet turn left heading three one zero

P= Canadian three one leaving one two thousand for four thousand feet clearance for tango NDB turning left to intercept say again heading

Stilpond terminal= three one zero

P= in the turn Canadian three one

Stilpond terminal= golf alpha romeo oscar three miles from tango NDB contact tower now one one nine decimal nine good day

P= oscar

Stilpond terminal= tower terminal point out

Tower= go ahead

Stilpond terminal= Canadian three one twenty miles south of VOR is Canadian three one hell-be number two for approach behind Ascot five four five two

Tower= charlie charlie

Eastview= Stilpond Eastview handoff on the zero nine two degree radial

Stilpond terminal= Eastview Stilpond terminal go ahead your handoff

Eastview= Stilpond zero nine two degree radial two miles east of the boundary Norontair two six two one zero thousand

Stilpond terminal= Nordair two six two radar identified request control for vectors

Eastview= your control charlie charlie

Stilpond terminal= *****

Stilpond terminal= Nordair two six two Stilpond terminal are you on frequency

P= Norontair two six two is on frequency one zero thousand
Stilpond terminal= Nordair two six two Stilpond altimeter three zero zero zero vectors iiiii traffic turn right heading three zero zero

P= Confirm that for Norontair two six two right turn three zero zero

Stilpond terminal= Nordair two six two roger turn right heading three zero zero

P= can you change that in Norontair

Stilpond terminal= right or whatever you say Nordair

Stilpond terminal= Ascot five four five four turn right heading zero two zero

P= Ascot five four five two roger turning right sorry say again heading

Stilpond terminal= zero two zero

P= ok Ascot five four five two turning right zero two zero

Stilpond terminal= *****

Tower= terminal tower

Stilpond terminal= tower terminal go ahead

Tower= Canforce three two three is taxiing and number two behind him golf romeo charlie oscar

Stilpond terminal= ok roger

P= Ascot five four five two up at four thousand

Stilpond terminal= Ascot five four five two roger

Eastview= Stilpond Eastview handoff on the zero nine two degree radial

Stilpond terminal= Stilpond terminal Eastview go ahead

Eastview= Stilpond zero nine two degree radial four miles east of the boundary foxtrot november whiskey foxtrot eight thousand

Stilpond terminal= foxtrot november whiskey foxtrot radar identified request control for vectors

Eastview= your control charlie charlie

P= Stilpond terminal foxtrot november whiskey foxtrot on frequency eight thousand

Stilpond terminal= foxtrot november whiskey foxtrot Stilpond terminal Stilpond altimeter three zero zero zero cleared to the tango NDB vectors to the final approach course maintain eight thousand turn right heading two nine zero

P= foxtrot november whiskey foxtrot turning right heading two niner zero maintain eight thousand

P= Stilpond canadian three one level four thousand

Stilpond terminal= canadian three one roger

Stilpond terminal= Ascot five four five two nine miles from the tango NDB thirteen miles from the threshold turn right heading zero eight zero to intercept final approach course upon interception of the final approach course cleared to the airport for a straight in back course runway one one approach

P= Ascot five four five two right turn zero eight zero to intercept the on course and on intercept we-re cleared to the airport for straight in localizer back course one one

Stilpond terminal= Ascot five four five two roger

Tower= Stilpond Eastview euh correction we-ll try that one again terminal tower

Stilpond terminal= tower terminal go ahead

Tower= Canforce three two three is ready

Stilpond terminal= three two three is valid *****

Tower= roger

APPENDIX I : Vocabulary used by trainee controllers in complex exercises

COMBINED VOCABULARIES
(Transcr. 3a and 4a)

A
AFFIRMATIVE
AGAIN
AIRCRAFT
AIRPORT
ALTIMETER
ALTITUDE
AMEND
AN
AND
APPROACH
ARE
AT
BACK
BREAK
CALLING
CAN
CHECK
CLEAR
CLEARED
CONFIRM
CONTACT
CORRECTION
COURSE
DAY
DECIMAL
DEGREE
EUH
FEET
FINAL
FIRST
FLIGHT
FOR
FREQUENCY
FROM
GOOD
HEADING
IDENTIFIED
INTERCEPT
INTERCEPTION
LEAVING

	LEFT
	LEVEL
	LOCALIZER
	MAINTAIN
	MILES
	NAVIGATION
	NDB
	NEGATIVE
	NORMAL
	NOW
	OF
	OFF
	ON
	POSITION
	PRESENT
	RADAR
	RADIAL
	REPORT
	RESUME
	RIGHT
	ROGER
	RUNWAY
	SAY
	SPACING
	STANDBY
	STRAIGHT-IN
	THAT-S
	THE
	THEN
	THRESHOLD
	THROUGH
	TO
	TOUCHDOWN
	TRAFFIC
	TURN
	UPON
	VECTORS
	YOU
	YOUR
	YOU-RE
	==========
Total (without iiiii and *****)	81

APPENDICE J : Draft of additional frames for complex exercises

FRAME : ALTI*I

Trans.	Msg no.		Content of message							
1a	8	canforce stilpond	five	four	zero	four				
	137	stilpond	altimeterthree	zero	zero	zero				
	219	stilpond	altimeterthree	zero	zero	zero				
	234	stilpond	altimeterthree	zero	zero	zero				
4a	8	...	stilpond	altimeterthree	zero	zero	zero	...		
	11	stilpond	altimeterthree	zero	zero	zero				
		*******	*******	*******	*******	*******	*******	*******	*******	
		callsign		altim.	ref.	"altimeter"		alt. reading		

FRAME : ALTIM2

Trans.	Msg no.		Content of message							
1a	9	three roger	zero	zero	zero	canforce	five	four	zero	four
	139	three	zero	zero	zero	uniform	november	roger		
	220	check roger	three	zero	zero	zero	nerontairtwo		six	two
	235	whiskey	foxtrot	check	three	zero	zero	zero		
		*******	*******	*******	*******	*******	*******	*******	*******	******
		alt. reading	"check" callsign							

FRAME : CFAD

Trans.	Msg no.	Content of message								
3a	11 ... final	cleared	to	the	tango	NDB	vectors	to	the	
		approach	course	turn	right	heading	two	niner	zero	
	13 and zero	india	oscar	golf	stilpond	altimeterthree	zero	zero		
	21 ... final eight	cleared	to	the	tango	NDB	vectors	to	the	
		course	turn	right	heading	two	niner	zero	maintain	
		thousand	stilpond	altimeterthree	zero	zero	zero			
	141 golf vectors heading	sierra	uniform	november	cleared	to	the	tango	NDB	
		to	intercept	the	final	approach	course	turn	right	
		one	four	zero						
	143 and	uniform	november	maintain	four	thousand				
	154 ... final altimeter	cleared	to	the	tango	NDB	vectors	to	the	
		approach	course	maintain	heading	maintain	altitude	stilpond		
		three	zero	zero	zero					
	182 ... final maintain	cleared	to	the	tango	NDB	vectors	to	the	
		approach	course	turn	left	heading	three	three	zero	
		six	thousand							
	200 ... intercept two	clear	to	the	tango	NDB	vectors	to		
		the	final	approach	course	turn	left	heading	three	
		iiiii	three	two	zero	maintain	seven	thousand		
	236 and to altitude	whiskey	foxtrot	cleared	to	the	tango	NDB	vectors	
		final	approach	course	maintain	present	heading	maintain	present	
4a	12 foxtrot vectors thousand	india	oscar	golf	cleared	to	the	tango	NDB	
		to	the	final	approach	course	maintain	one	zero	
		maintain	present	heading						
	22 foxtrot zero vectors feet	sierra	hotel	alpha	midtown	center	stilpond	altimeterthree		
		zero	zero	cleared	to	the	tango	NDB	radar	
		to	the	final	approach	course	maintain	four	thousand	
		maintain	present	heading						
	165 ... the approach	stilpond	altimeterthree	zero	zero	zero	clear	to		
		tango	NDB	radar	vectors	to	intercept	the	final	
		course	maintain	nine	thousand	maintain	present	heading		
	181 stilpond tango heading	altimeterthree	zero	zero	zero	clear	to	the		
		vectors	to	the	final	approach	course	maintain	present	
	208 ... to course zero	stilpond	altimeterthree	zero	zero	zero	check	clear		
		the	tango	NDB	vectors	to	the	final	approach	
		maintain	present	altitude	turn	left	heading	three	two	
	240 canadian tango the turn	three	one	stilpond	altimeterthree	zero	zero	zero		
		clear	to	the	tango	NDB	radar	vectors	to	
		final	final	approach	course	maintain	four	thousand	feet	
		left	heading	three	one	zero				
	280 foxtrot zero to right	november	whiskey	foxtrot	stilpond	terminal	stilpond	altimeterthree		
		zero	zero	cleared	to	the	tango	NDB	vectors	
		the	final	approach	course	maintain	eight	thousand	turn	
		heading	two	nine	zero					

"cleared" "to" "the" beacon "vectors" "to" "intercept" "the" "final""approach" "course" "turn" side "heading" heading "maintain" "present" altitude "maintain" "present" heading altim. ref. "altimeter" altim. reading

FRAME : CFAE

Trans.	Msg no.	Content of message								
Ja	12	*****	cleared	tango	NDB	right	turn	two	nine	zero
		india	oscar	golf	roger					
	14	check	three	zero	zero	zero	india	oscar	golf	roger
	22	check	three	zero	zero	zero	hotel	alpha	cleared	to
		tango	NDB	right	turn	heading	two	nine	zero	maintain
		present	altitude							
	142	to	the	tango	NDB	right	turn	one	four	zero
		uniform	november	roger						
	144	uniform	november	leaving	nine	for	four	roger		
	155	check	three	zero	zero	zero	romeo	oscar	will	
		maintain	altitude							
	183	ascot	five	four	five	two	cleared	to	tango	NDB
		and	left	turn	heading	three	three	zero	leaving	one
		two	thousand	for	six	thousand	roger			
	201	cleared	to	tango	iiiii	cleared	to	tango	NDB	leaving
		one	two	thousand	for	seven	and	left	turn	heading
		three	two	zero	roger					
	237	whiskey	foxtrot	cleared	to	tango	NDB	present	heading	and
		altitude	roger							
4a	13	foxtrot	india	oscar	golf	maintain	present	heading	one	zero
		thousand	*****	tango						
	23	sierra	hotel	alpha	maintain	four	thousand	feet	leaving	eight
		thousand	now	and	present	heading				
	166	november	roger	maintain	niner	thousand	present	heading		
	182	alpha	romeo	oscar	*****	tango	present	heading	present	
		altitude								
	209	ascot	five	four	five	two	turning	left	heading	three
		two	zero	maintain	one	two	thousand			
	241	canadian	three	one	leaving	one	two	thousand	for	four
		thousand	feet		clearance	for	tango	NDB	turning	left
		to	intercept	say	again	heading				
	281	foxtrot	november	whiskey	foxtrot	turning	right	heading	two	niner
		zero	maintain	eight	thousand					
		*******	*******	*******	*******	*******	*******	*******	*******	*******

"cleared" beacon side "turn" callsign "to" "maintain" "present" heading altitude

FRAME : CARD

Trans.	Msg no.	Content of message								
3a	72	foxtrot	india	oscar	golf	cleared	to	the	stilpond	airport
		for	a	straight-in	localizerback-course			runway	one	
		one	approach	to	interceptlocalizerturn		left	heading	one	
		four	zero							
	125	-then	foxtrot	sierra	hotel	alpha	cleared	to	the	
		stilpond	airport	for	a	straight-in	localizerback-course			
		runway	one	one						
		approach								
	(160	golf	sierra	uniform	november	*****	interception	of	the	
		localizer	you-re	cleared	to	the	stilpond	airport	for	a
		localizercorrectio	straight-in	localizerback-course			for	the		
		one	one	approach						
	188	romeo	oscar	clear	to	the	romeo	oscar	clear	to
		the	stilpond	airport	for	a	straight-in			
		localizerback-course	one	one	approach	interceptlocalizerturn				
		left	heading	one	four	zero				
	231	ascot	five	four	five	two	cleared	to	the	
		stilpond	airport	for	a	straight-in	localizerback-course			
		runway	one	one	approach	turn	right	heading	zero	eight
		zero	to	interceptlocalizer						
4a	72	foxtrot	india	oscar	golf	eight	miles	from	the	tango
		NDB	twelve	miles	from	the	thresholdturn	left	heading	
		two	heading	one	four	zero	to	interceptfinal	approach	
		course	upon	intercept	you-re	clear	to	the		
		airport	first	straight-in	back-course	runway	one	one		
		approach								
	(140	foxtrot	sierra	hotel	alpha	seven	miles	from	the	tango
		NDB	eleven	miles	from	the	thresholdturn	left		
		heading	two	two	six	zero	to	interceptthe		
		localizer	upon	interceptyou-re	clear	to	the	airport	for	
		a	straight-in	back-course	runway	one	one	approach		
	(141	*****	check	*****	left	*****	to	a	heading	one
		four	zero							
	191	golf	sierra	uniform	november	ten	miles	west	of	the
		tango	NDB	fourteen	miles	from	the	thresholdturn	right	
		heading	one	four	zero	to	interceptfinal	approach	course	
		upon	interception	of	the	final	approach	course	clear	
		for	straight-in	back-course	runway	one	one	approach		
	233	...	golf	alpha	romeo	oscar	turn	left	heading	one
		four	zero	to	interceptthe	localizer				
	235	...	seven	miles	from	the	tango	NDB	eleven	miles
		from	the	thresholdupon	interceptof	the	localizerclear			
		to	the	airport	for	a	straight-in	back-course		
		runway	one	one	approach					
	284	ascot	five	four	five	two	nine	miles	from	the
		tango	NDB	thirteen	miles	from	the	thresholdturn	right	
		heading	zero	eight	zero	to	interceptfinal	approach	course	
		upon	interception	of	the	final	approach	cleared	to	
		the	airport	for	a	straight-in	back-course	runway	one	
		one	approach							
		*****	*****	*******	*******	*******	*******	*******	*******	*******

callsign position "cleared" "to" "the" airport "airport" "for" "a" "straight-in" "localizer""back-course" "runway" runway "approach" "to" "intercept" "the" "localizer" "turn" side"heading" heading

FRAME : CARE

Trans.	Msg no.	Content of message								
3a	73	left	one	four	zero	to	interceptthe	localizercleared		
		to	straight-in	back-course	one	one	oscar	golf	roger	
	127	cleared	to	straight-in	localizerback-course	one	one			
		sierra	hotel	alpha	roger					
	161	cleared	in	localizerback-course	one	one	uniform			
		november								
	189	left	one	four	zero	to	interceptclear	to		
		straight-in	localizer	back-course	one	one	alpha	romeo		
		oscar								
	232	right	turn	heading	zero	eight	zero	to	interceptthe	
		localizer	cleared	to	straight-in	localizerback-course	one			
		one	ascot	five	four	five	two	roger		
4a	73	foxtrot	india	oscar	golf	left	turn	heading	one	four
		zero	to	intercept*****	to	the	airport	straight-in		
		localizerback-course	runway	one	one	approach				
	142	*****	turn	left	heading	one	four	zero	to	
		intercept	the	on	course	then	we-re	clear	to	the
		airport	for	a	straight-in	localizerback-courone	one	on		
		*****								
	192	sierra	uniform	november	right	turn	heading	one	four	zero
		to	interceptand	on	the	intercept*****	cleared	to		
		the	airport	straight-in	localizerback-course	one	one			
	234	alpha	romeo	oscar	left	heading	one	four	zero	to
		intercept	the	localizer						
	236	alpha	romeo	oscar	on	the	interceptclear	to	the	
		airport	for	a	straight-in	back-course	runway	pme		
		one	thanks							
	285	ascot	five	four	five	two	right	turn	zero	eight
		zero	to	interceptthe	on	course	and	on		
		interceptwe-re	cleared	to	the	airport	for	straight-in		
		localizerback-course	one	one						
		*****	*******	*******	*******	*******	*******	*******	*******	*******

side "turn" "to" "intercept" "localizer" "cleared" "to" "straight-in" "localizer" "back-course" runway callsign

FRAME : DEPD

Trans.	Msg no.	Content of message								
3a	64	foxtrot	sierra	india	mike	stilpond	terminal	radar	identified	
		maintain	one	six	thousand	through	five	thousand	turn	right
		heading	two	three	zero					
	81	alpha	sierra	india	mike	report	leaving	niner	thousand	
	93	november	three	one	zero	echo	lima	maintain	one	
		thousand	through	five	thousand	turn	right	heading	two	zero
		zero								
	95	and	echo	lima	report	leaving	niner	thousand		
	121	whiskey	tango	terminal	radar	identified	euh	maintain	seven	
		thousand								
	(250	canforce	three	two	three	stilpond	terminal	radar	identified	
		*****								
4a		position	report	through	five	thousand	turn	right	heading	two
		zero	zero							
	77	...	maintain	one	one	thousand	upon	leaving	five	
		thousand	turn	right	heading	two	four	zero	report	leaving
		nine	thousand							
	168	x-ray	whiskey	tango	radar	identifiemaintain	seven	thousand	feet	
		upon	leaving	five	thousand	turn	left	heading	zero	two
		zero								
		*****	*******	*******	*******	*******	*******	*******	*******	*******

callsign center "radar" "identified" "maintain" altitude "through" altitude "turn" side "heading" heading

FRAME : DEPE

Trans.	Msg no.	Content of message								
3a	65	india	mike	we-re	just	passing	through	five	now	i-ll
		climb	to	one	six	thousand	and	right	turn	heading
		two	three		zero					
	82	india	mike	i-m	at	nine	thousand	now		
	94	november	three	one	zero	echo	lima	cleared	to	one
		one	thousand	at	five	right	turn	to	heading	two
		zero	zero	roger						
	96	three	one	zero	echo	lima	call	you	through	nine
		roger								
	122	whiskey	tango	cleared	to	seven	roger	out	of	four
		thousand	five	hundred	now					
	(251	canforce	three	two	three	out	of	five	right	two
		zero	zero	confirm						
	(253	cleared	to	nine	out	of	five	right	two	zero
		zero	canforce	three	two	three	roger			
4a	78	foxtrot	sierra	india	mike	climb	to	one	one	
		thousand	call	through	nine	thousand	*****	and	when	we-re
		out	of	five	thousand	cleared	to	the	right	turn
		on	a	heading	of	two	four	zero		
	169	x-ray	whiskey	tango	climb	to	seven	thousand	out	of
		five	thousand	left	turn	heading	zero	two	zero	

callsign "i-m at" altitude "and" side "turn" "heading" heading "we-re just passing through" "i-ll climb to" "cleared to"

FRAME : DPIO

Trans.	Msg no.	Content of message								
3a	63	stilpond	terminal	foxtrot	sierra	india	mike	your	frequency	on
		departure	out	of	four	for	six			
	92	stilpond	terminal	november	three	one	zero	echo	lima	on
		departure	*****	*****	six					
	120	stilpond	terminal	foxtrot	x-ray	whiskey	tango	your	frequency	on
		departure	out	of	four	for	six			
4a	167	stilpond	terminal	x-ray	whiskey	tango	is	with	you	i-m
		climbing	to	six	thousand					

center callsign "your" "frequency" "on" "departure" "out of" current-altitude "for" next-altitude

FRAME : POSI

Trans.	Msg no.	Content of message								
3a	151	golf	sierra	uniform	november	twenty	miles	north	west	of
		tango	twenty	five	miles	from	touchdown			

callsign position

FRAME : RAD

Trans.	Msg no.	Content of message		
4a	129	...	you-re	identified...

"you-re" "identified

APPENDIX K : Analysis of concatenated transmissions

CASE WHERE MANY MESSAGES TO THE SAME RECIPIENT ARE CONCATENATED IN A SINGLE TRANSMISSION:

Transcr.	Msg	Description							
3a	11	foxtrot	india	oscar	golf	stilpond	terminal	roger	cleared
		to	the	tango	NDB	vectors	to	the	final
		approach	course	turn	...				
	21	foxtrot	hotel	sierra	correctiofoxtrot		sierra	hotel	alpha
		stilpond	terminal	roger	cleared	to	the	tango	NDB
		vectors	for	the	...				
	118	november	three	one	zero	echo	lima	turn	right
		heading	two	four	zero	contact	iiiii	contact	midtown
		center	one	three	...				
	137	golf	sierra	uniform	november	stilpond	terminal	roger	stilpond
		terminal	correction		stilpond	altimeterthree		zero	zero
		zero							
	154	golf	alpha	romeo	oscar	stilpond	terminal	roger	cleared
		to	the	tango	NDB	vectors	to	the	final
		approach	course	maintain	...				
	182	ascot	five	four	five	two	stilpond	terminal	roger
		cleared	to	the	tango	NDB	vectors	to	the
		final	approach	course	...				
	200	canadian	three	one	stilpond	terminal	roger	clear	to
		the	tango	NDB	vectors	to	interceptthe		final
		approach	course	turn	...				
	219	norontairtwo		six	two	stilpond	terminal	roger	stilpond
		altimeterthree		zero	zero	zero			
	234	foxtrot	november	whiskey	foxtrot	stilpond	terminal	roger	stilpond
		altimeterthree		zero	zero	zero			
4a	8	canforce	five	four	zero	four	stilpond	iiiii	stilpond
		altimeterthree		zero	zero	vectors	for	spacing	turn
		right	heading	nine	zero				
	11	foxtrot	india	oscar	golf	stilpond	terminal	stilpond	
		altimeterthree		zero	zero	zero			
	79	sierra	india	mike	roger	and	check	you-re	radar
		identified							
	129	stilpond	iiiii	say	you-re	identifiesay		your	present
		altitude							
	132	november	three	one	*****	maintain	flight	level	one
		eight	zero	turn	right	heading	two	iiiii	two
		four	zero						
	165	golf	sierra	uniform	november	stilpond	terminal	roger	stilpond
		altimeterthree		zero	zero	zero	clear	to	the
		tango	NDB	radar	...				
	193	golf	alpha	romeo	oscar	turn	right	heading	two
		seven	zero	maintain	eight	thousand			
	208	ascot	five	four	five	two	roger	stilpond	
		altimeterthree		zero	zero	turn	check	clear	to
		the	tango	NDB	vectors	...			
	280	foxtrot	november	whiskey	foxtrot	stilpond	terminal	stilpond	
		altimeterthree		zero	zero	zero	cleared	to	the
		tango	NDB	vectors	to	...			

Observed patterns :

msg K msg 2

msg 1 msg 2

(msg 1)msg 2

CASE WHERE MANY MESSAGES FOR DIFFERENT RECIPIENTS ARE CONCATENATED IN A SINGLE TRANSMISSION

Transcr.	Msg	Description
1a	10	november nine hundred papa bravo center roger break Air Canada nine five one maintain one two thousand Stilpond altimeter...
	55	lufthansafour seventy one center roger break Air France zero three one maintain one two thousand Stilpond altimetertwo ...
	83	canadian six three disregardeuh maintain heading three five five air canada eight five seven vectors for spacing turn ...
	103	alitalia six six five center roger break air canada eight five seven maintain one two thousand Stilpond altimetertwo ...
	112	air canada eight fifty seven center roger break canadian sixty three maintain one two thousand stilpond altimetertwo niner ...
2a	4	november nine zero zero center roger break air canada nine five one maintain one two thousand Stilpond altimetertwo ...
	40	lufthansafour seven one center roger break air france zero three one maintain one two thousand stilpond altimetertwo ...
	87	alitalia six six five center roger break air canada eight five seven maintain one two thousand Stilpond altimetertwo ...
4a	40	foxtrot sierra hotel alpha roger break foxtrot india oscar golf report leaving seven thousand
	233	canadian three one standby golf alpha romeo oscar turn left heading one four zero to interceptthe localizer

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Observed patterns : callsign 1 msg K "break" callsign 2 msg 2

callsign 1 (msg 1) callsign 2 msg 2

callsign 1 msg SB callsign 2 msg 2

APPENDIX L : Vocabulary used by pseudo-pilots

Transcripts 1A and 2A :

Words (transcr. 1A)	Words (transcr. 2A)	Words (1A and 2A combined)
A	A	A
ALTIMETER	AHEAD	AHEAD
AND	AIRWAY	AIRWAY
AGREED	ALTIMETER	ALTIMETER
AT	AND	AND
CALL	ARE	ARE
CHECK	AT	AGREED
CONFIRM	CALL	AT
DAY	CHECK	CALL
DESCEND	COURSE	CHECK
END	DAY	CONFIRM
GUN	DON-T	COURSE
FLIGHT	GUN	DAY
FOR	FLIGHT	DESCEWT
FREQUENCY	FOR	DON-T
GOOD	FREQUENCY	END
I	GO	GUN
IN	GOOD	FLIGHT
INTERCEPT	HEADING	FOR
LEAVING	I	FREQUENCY
LEFT	INTERCEPT	GO
LEVEL	I-M	GOOD
NOW	JUST	HEADING
OF	LEAVING	I
PASSING	LEFT	IN
RADIAL	LEVEL	INTERCEPT
RIGHT	MISSED	I-M
ROGER	NOW	JUST
STEADY	OH	LEAVING
THE	ON	LEFT
THROUGH	PASSING	LEVEL
TO	RIGHT	MISSED
TOWN	ROGER	NOW
TURN	SORRY	OF
WE-RE	STEADY	OH
WILL	THAT	ON
WITH	THE	PASSING
YOU	THING	RADIAL
YOUR	THROUGH	RIGHT
	TO	ROGER
	TOWN	SORRY
	TURN	STEADY
	WE	THAT
	WE-LL	THE
	WE-RE	THING
	WILL	THROUGH
	WITH	TO
	YOU	TOWN
	YOUR	TURN
		WE
		WE-LL
		WE-RE
		WILL
		WITH
		YOU
		YOUR
29 words	49 words	56 words

Transcr. 3A et 4A

Mots nets (Transcr. 3a)	Mots nets (Transcr. 4a)	Mots nets (transcr. combinees)
A	A	A
AIRBORNE	AGAIN	AGAIN
ALTITUDE	AIRPORT	AIRBORNE
AND	AIRWAY	AIRPORT
AT	ALTITUDE	AIRWAY
BACK	AND	ALTITUDE
CALL	APPROACH	AND
CHECK	AT	APPROACH
CLEAR	BACK	AT
CLEARED	BIT	BACK
CLIMB	CALL	BIT
CONFIRM	CALLING	CALL
COURSE	CAN	CALLING
DAY	CHANGE	CAN
DEPARTURE	CHECK	CHANGE
EUH	CLEAR	CHECK
FOR	CLEARANCE	CLEAR
FREQUENCY	CLEARED	CLEARANCE
GOOD	CLIMB	CLEARED
HEADING	CLIMBING	CLIMB
IN	CONFIRM	CLIMBING
INSTEAD	COURSE	CONFIRM
INTERCEPT	DAY	COURSE
I-LL	DECIMAL	DAY
I-M	ESTABLISHED	DECIMAL
JUST	FEET	DEPARTURE
LEAVING	FLIGHT	ESTABLISHED
LEFT	FOR	EUH
LEVEL	FREQUENCY	FEET
LOCALIZER	GOOD	FLIGHT
MAINTAIN	HEADING	FOR
NDB	IN	FREQUENCY
NOW	INTERCEPT	GOOD
OF	IS	HEADING
ON	IT	IN
OUR	I-M	INSTEAD
OUT	JUST	INTERCEPT
PASSING	LEAVING	IS
PRESENT	LEFT	IT
RIGHT	LEVEL	I-LL
ROGER	LITTLE	I-M
SET	LOCALIZER	JUST
STRAIGHT-IN	MAINTAIN	LEAVING
SWITCHING	MORNING	LEFT
THE	NDB	LEVEL
THIS	NEGATIVE	LITTLE
THROUGH	NOW	LOCALIZER
TIME	OF	MAINTAIN
TO	OK	MORNING
TURN	ON	NDB
TURNING	OUR	NEGATIVE
WE-LL	OUT	NOW
WE-RE	PICK	OF
WILL	PRESENT	OK
WITH	RIGHT	ON
YOU	ROGER	OUR
YOUR	RUNWAY	OUT
	SAY	PASSING
	SET	PICK
	SORRY	PRESENT
	STRAIGHT-IN	RIGHT
	THANKS	ROGER
	THAT	RUNWAY
	THE	SAY
	THEN	SET
	THIS	SORRY
	THROUGH	STRAIGHT-IN
	TO	SWITCHING
	TURN	THANKS
	TURNING	THAT
	UP	THE
	WE-RE	THEN

	WHEN	THIS
	WILL	THROUGH
	WITH	TIME
	YOU	TO
	YOUR	TURN
		TURNING
		UP
		WE-LL
		WE-RE
		WHEN
		WILL
		WITH
		YOU
		YOUR
57 words	77 words	86 words